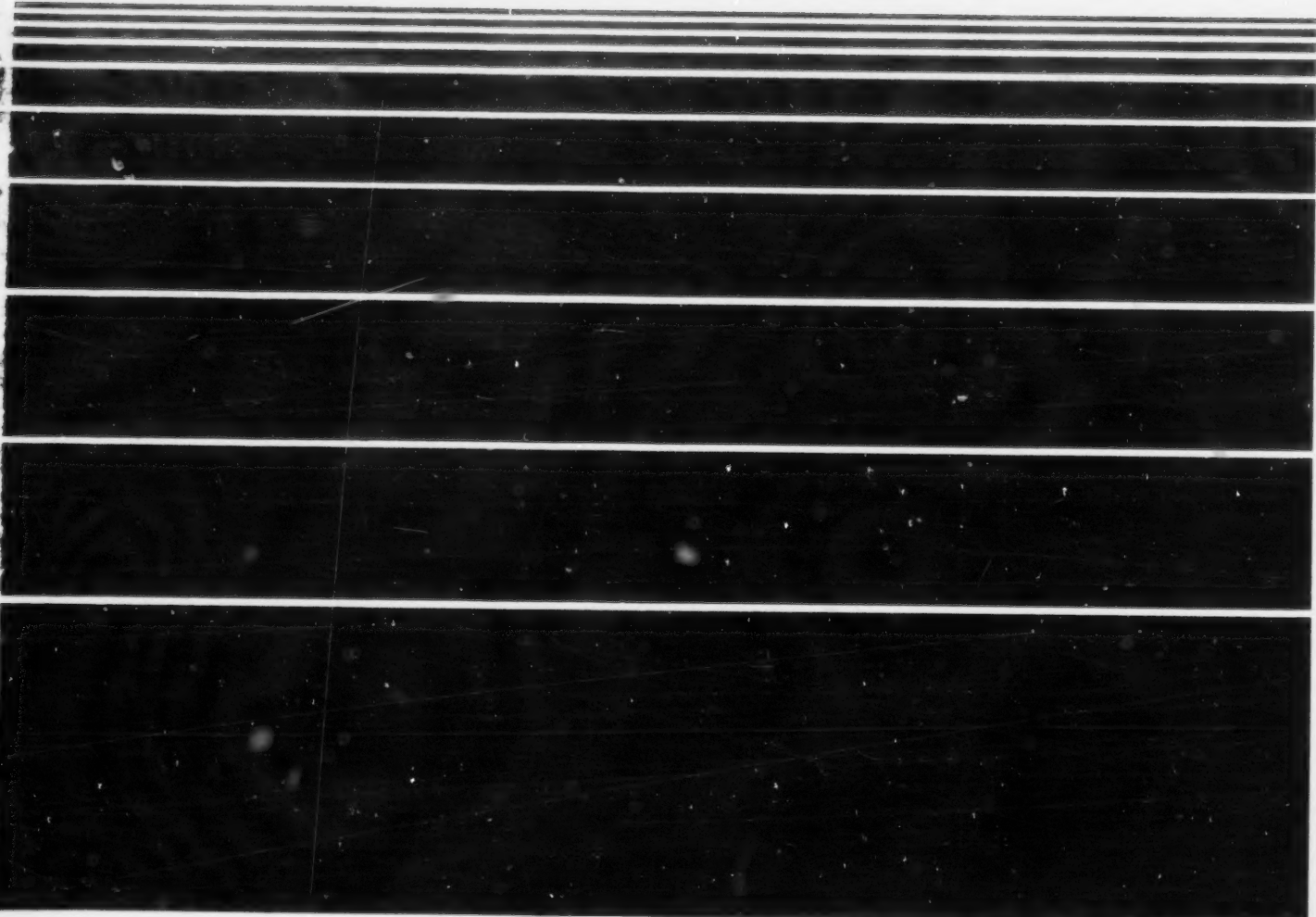




Manitoba
Environment
and Workplace
Safety and Health



MANITOBA AMBIENT AIR QUALITY
ANNUAL REPORT - 1986

Air Standards and Studies Section
Environmental Management Services Branch

Air Standards and Studies
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ABSTRACT

As part of an on-going environmental quality monitoring program, the Manitoba Department of Environment and Workplace Safety and Health monitored the quality of ambient air at several urban locations during 1986. This monitoring consisted of the use of established monitoring sites having dedicated instrumentation for continuous air sampling and analysis.

The ambient air quality program is structured to determine air quality in two areas: general urban air quality and air quality in the vicinity of specific industries.

The general urban air quality program consisted primarily of sampling activities within the Federal/Provincial National Air Pollution Surveillance (NAPS) program. Sampling at NAPS sites consisted of measurement of the common air pollutants including carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide, total suspended particulate matter, soiling index, lead, sulphates, and nitrates. Of these contaminants, total suspended particulate matter and ozone most often exceeded the Provincial air quality objectives. Based on the Canadian Annual Index of Air Quality, Winnipeg's downtown air quality was rated as "FAIR" whereas Winnipeg's residential air quality was rated as "GOOD".

The monitoring of air quality in the vicinity of specific industries having (or potentially having) atmospheric emissions was restricted to the areas around the Northern smelters (at Flin Flon and Thompson), the pulp and paper mill at The Pas, and an ammonia fertilizer manufacturer in Brandon. Monitoring was specifically for the pollutant of industrial emission. Data from the above locations showed that, on occasion, levels above air quality objectives and/or guidelines were measured.

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INTRODUCTION

The Air Standards and Studies Section of Manitoba Environment and Workplace Safety and Health has been monitoring ambient air at several locations throughout Manitoba since 1968. Monitoring activities in 1986 took place in Winnipeg, Brandon, Thompson, Flin Flon and The Pas.

The majority of sampling is of a continuous nature involving dedicated monitors in permanent stations and can be divided into two basic categories; (1) General or Urban Air Quality monitoring and (2) Source specific or Industrial monitoring. Much of the General or Urban Air Quality monitoring is performed under the auspices of the Federal Government's National Air Pollution Surveillance (NAPS) program, which provides a nationwide data base for determining the extent of air pollution in Canada, and also documents trends arising as a result of changing industrial activity, fuel use, population density and use of pollution control strategies.

Source specific or Industrial monitoring is performed by the Impingement Program within the Air Standards and Studies Section. This monitoring contributes to the evaluation of ambient air quality in the vicinity of specific industries in order to determine compliance with Provincial air quality guidelines and objectives.

This report covers the 1986 data for the following parameters: Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), Nitric Oxide (NO), Ozone (O₃), Ammonia (NH₃), Hydrogen Sulphide (H₂S), Sulphur Dioxide (SO₂), Soiling Index (COH), Total Suspended Particulate (TSP), Lead (Pb), Sulphates (SO₄), and Nitrates (NO₃).

The objectives of this report are; (1) to outline ambient air monitoring activities in the Province during 1986, (2) to provide summary statistics and a comparison to air quality objectives and/or guidelines (where applicable), (3) to compare 1986 data with previous years and (4) to provide a rating of the air quality relative to the Canadian Annual Index of Air Quality.

BACKGROUND

A) Manitoba Air Quality Objectives and Guidelines

The Province of Manitoba has adopted the National Ambient Air Quality objectives for those pollutants for which such objectives have been promulgated (sulphur dioxide, suspended particulate matter, carbon monoxide, ozone and nitrogen dioxide). Air Quality Guidelines have been developed and adopted internally for the remaining pollutants.

The above criteria have been designed about three levels:

Maximum Tolerable Level (MTL) - these criteria pollutant levels are those which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.

Maximum Acceptable Level (MAL) - these criteria pollutant levels are intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well being.

Maximum Desirable Level (MDL) - these criteria pollutant levels define long term goals for air quality and provide a basis for an antidegradation policy for the unpolluted part of the country and for the continuing development of control technology.

In the majority of cases, urban air quality is expected to meet the MAL, whereas, in rural areas, it is the long term goal to ensure that the MDL's are not exceeded.

A list of "Ambient Air Criteria" currently endorsed by Manitoba Environment and Workplace Safety and Health is presented in Table 1.

TABLE 1

OBJECTIVES AND GUIDELINES FOR VARIOUS AIR POLLUTANTS

AMBIENT AIR CRITERIA

The following schedule lists maximum time-based pollutant concentration levels for the protection and preservation of ambient air quality within the Province of Manitoba. Each contaminant is classified either as objective or guideline status depending upon several factors. The objective classification is directed toward those air pollutants sufficiently widespread in presence and of potential environmental effect that formulation of limits has been thorough and well documented. The guideline classification is used for those pollutants of a more localized presence and for which a lesser degree of documentation in support of the chosen criteria is available.

For the air contaminants mentioned in Column 1, the amount thereof in the outside air measured in the units set out in Column 2 during the period of time set out in Column 3, shall not be in greater concentration than the amount shown in:

- Column 4 representing the **MAXIMUM TOLERABLE LEVEL** which denotes a time - based concentration of air contaminant beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.
- Column 5 representing the **MAXIMUM ACCEPTABLE LEVEL** which is deemed essential to provide adequate protection for soils, water, vegetation, materials, animals, visibility, personal comfort and well-being.
- Column 6 represents the **MAXIMUM DESIRABLE LEVEL** which defines the long term goal for air quality and provides a basis for an anti-degradation policy for the unpolluted parts of Manitoba and for the continuing development of control technology.

This schedule is intended to serve as a guide for the evaluation of air quality and for planning purposes. The selection of the appropriate concentration category will depend upon the degree of protection to be afforded to effected receptors. Maximum Tolerable Levels are only for evaluation purposes to identify the severity of an anthropogenic or natural phenomenon in order to protect human health and institute appropriate corrective action. In general, Maximum Acceptable Levels are not to be exceeded in any urban centre including areas that are in the vicinity of industries with atmospheric emissions. Within rural areas, it is the goal to maintain pollutant concentrations at or below Maximum Desirable Levels.

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6	
Name of Contaminant	Contaminant Classification	Units of Concentration Measurement	Period of Time Contaminant is Measured	Maximum Tolerable Level Concentration	Maximum Acceptable Level Concentration	Maximum Desirable Level Concentration
Amonia	Guideline	milligrams per cubic metre (parts per million) of air	1-hour average	1.4 (2.6)		
Carbon Monoxide	Objective	milligrams per cubic metre (parts per million) of air	1-hour average 8-hour average	35 (30) 20 (17)	15 (13) 6 (5)	15 (13) 6 (5)
Chromic Acid (as Cr+6)	Guideline	micrograms per cubic metre of air	1-hour average	4.5		
Dustfall in Excess of Normal Background Levels	Guideline	milligrams per square centimetre (tons per square mile per month)	air basin average 30 days single point 30 days	0.8 (22.8) 1.5 (42.8)	0.6 (17.1) 1.1 (31.4)	
Fluorides (as Fluoridation)	Guideline	micrograms per 100 square centimetres	30 days	40		
Fluorides (as HF)	Guideline	micrograms per cubic metre (parts per billion) of air	24-hr. average 7 day average 30 day average 70 day average	0.85 (1.06) 0.55 (0.69) 0.35 (0.44) 0.20 (0.25)	0.40 (0.50) 0.22 (0.28)	
Hydrogen Chloride	Guideline	micrograms per cubic metre (parts per million) of air	1-hr. average	100 (.07)		
Hydrogen Sulphide	Guideline	micrograms per cubic metre (parts per billion) of air	1-hour average 24-hr. average	1400 (1000) 15 (11.0) 5 (4.0)	1 (0.7)	

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
Name of Contaminant	Contaminant Classification	Units of Concentration Measurement	Period of Time Contaminant is Measured	Maximum Tolerable Level Concentration	Maximum Acceptable Level Concentration
Lead	Guideline	micrograms per cubic metre of air	24-hr. average	5.0	Maximum Desirable Level Concentration
Nitrogen Dioxide	Objective	micrograms per cubic metre (parts per million) of air	1-hour average 24-hr. average Annual arithmetic mean	400 (0.213) 200 (0.106) 100 (0.053)	60 (0.032)
Odours	Guideline	odour units	two tests not less than 15 minutes apart nor more than 60 minutes apart	Residential Zone 2.0 (one volume of odorous air diluted with one volume of odour free air) Industrial Zone 7.0 (one volume of odorous air diluted with six volumes of odour free air)	<1.0 (less than the odour threshold)
Oxidants (Ozone)	Objective	micrograms per cubic metre (parts per million) of air	1-hour average 24-hr. average Annual arithmetic mean	400 (.20) 160 (0.08) 50 (0.025) 30 (0.015)	100 (0.05) 30 (0.015)
Soiling Index	Guideline	coefficient of haze per 1000 feet of air	24-hr. average Annual arithmetic mean	1.0 0.45	0.45 0.3

Also see note on next page

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
Name of Contaminant	Contaminant Classification	Units of Concentration Measurement	Period of Time Contaminant is Measured	Maximum Tolerable Level Concentration	Maximum Acceptable Level Concentration
Sulphation	Guideline	milligrams of sulphur trioxide per 100 square centimetres per day	30 days	1.0	0.4
Sulphur Dioxide	Objective	micrograms per cubic metre (parts per million) of air	1-hour average 24-hr. average Annual arithmetic mean	900 (0.34) 300 (0.11) 60 (0.02)	450 (0.17) 150 (0.06) 30 (0.01)
Sulphuric Acid Mist	Guideline	micrograms per cubic metre (parts per million) of air	1-hr. average	100 (.025)	
Suspended Particulate Matter	Objective	micrograms per cubic metre of air	24-hr. average Annual geometric mean	400 70	120 60

Note: Odours:

The release of offensive odours past the property line of any source shall be eliminated, or minimized, such that the said odours will not interfere with the comfort, well-being or enjoyment of any person. In most situations, achieving the Maximum Acceptable Level, will satisfy this condition.

All measurements of air quality are corrected to a reference temperature of 25°C and to a reference pressure of 101.3 kilopascals.

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July, 1985

B) POLLUTANTS

Pollutants monitored in the Manitoba Ambient Air Quality Network included:

Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless and tasteless gas slightly lighter than air. It is considered a dangerous asphyxiant because it combines strongly with the hemoglobin of the blood and reduces the blood's ability to carry oxygen to cell tissues. CO is a product of incomplete combustion of carbon and is emitted by fossil fuel combustion sources (i.e. motor vehicle). CO is measured on a continuous basis by the technique of non-dispersive infrared spectrometry and the data is generally reported in the unit form of hourly averages from which further time-weighting can be determined.

Nitrogen Dioxide

Nitrogen dioxide (NO₂) is a reddish-brown gas with a pungent, irritating odour. It originates chiefly from combustion sources as well as from conversion of nitric oxide. Nitrogen dioxide exerts its primary toxic effect on the lungs and can be associated with increased susceptibility to respiratory infections and emphysematous changes. Nitrogen dioxide also suppresses vegetation growth, causes corrosion of metals, reduces visibility and acts as a

precursor with reactive hydrocarbons for oxidant formation. It is measured continuously by the technique of chemiluminescence with unit data reported as hourly averages.

Nitrogen oxides are also recognized as a significant contributor to the formation of acid rain.

Nitric Oxide

Nitric oxide (NO) is a colourless, odourless and tasteless gas which in nature is produced by biological action but in polluted atmospheres is produced primarily by fuel combustion in both stationary and mobile sources. By itself nitric oxide is not usually considered a pollutant but in a polluted atmosphere, it is readily oxidized to nitrogen dioxide through photochemical secondary reaction. Nitric oxide is measured concurrently with nitrogen dioxide by the technique of chemiluminescence and the data is processed as hourly averages.

Ozone

Ozone (O_3) is a pungent irritating gas formed at high altitudes by photochemical reaction involving molecular and atomic oxygen. Ozone and other oxidants are formed in polluted atmospheres as a result of a rather wide variety of photochemical reactions involving nitrogen oxides and reactive hydrocarbons. The overall effect of ozone is a stinging of the eyes and the mucous membranes.

It is also responsible for an increase in asthma effects and respiratory restriction. Ozone reduces vegetation yields, injures vegetation and weakens materials such as rubber and certain fabrics. Ozone is measured by use of the chemiluminescence technique and unit data reported as hourly averages.

Ammonia

Ammonia (NH_3) is a colourless gaseous alkaline compound of nitrogen and hydrogen. It is lighter than air, of extremely pungent smell and taste, and very soluble in water, and can be easily condensed by cold and pressure to a liquid. Ammonia is an important industrial and agricultural compound as well as a nuisance, but it is not a major pollutant of the environment. It is used both free and combined in medicine, the arts and industry. Ammonia is measured continuously by the technique of chemiluminescence with unit data reported as hourly averages.

Hydrogen Sulphide

Hydrogen sulphide (H_2S) is a toxic, foul smelling gas well-known for the rotten egg-like odour at a very low concentration. Hydrogen sulphide as an occasional air contaminant is almost always associated with some specific incident or industrial process. The concentration of hydrogen sulphide in the ambient air is rarely high enough to harm either vegetation or man. However, at high concentrations, it will produce loss of sense of smell, severe respiratory tract irritation and material damage such as the staining

of lead based paints. H_2S is measured continuously by the technique of pulsed fluorescence. Unit data is reported as hourly averages.

Sulphur Dioxide

Sulphur dioxide (SO_2) is a colourless gas with a pungent irritating odour emitted primarily from the combustion of fossil fuels containing sulphur, and from primary non-ferrous smelting. It is usually recognized as one of the major atmospheric pollutants. Sulphur dioxide produces an increased frequency of respiratory disease symptoms and lung disease. It also produces marked effects on vegetation, corrodes materials and may oxidize in the atmosphere to form sulphuric acid and sulphates. Sulphur dioxide along with nitrogen dioxide has been determined to contribute to acid rain.

Sulphur dioxide is measured by use of the coulometry and pulsed fluorescence techniques. Unit data is reported as hourly averages.

Soiling Index (Smoke)

Soiling index (COH) is an indication of the soiling or darkening potential of fine particulate in the atmosphere usually resulting from combustion. These particles are usually in the size range of 0.1 to 1 micron in diameter. A tape sampler is used to collect the "smoke" particles on a filter paper and the degree of light transmission on a bi-hourly basis is reported as Coefficient of Haze (COH) units.

Total Suspended Particulate

Total Suspended Particulate (TSP) is a general term which applies to a large variety of solid or liquid particles of a size and configuration such that they remain suspended in the air and can be drawn into the respiratory passages. These types of particles usually in the size range of 0.1 to 100 microns may originate as a result of industrial processes, human activities and from natural sources such as wind swept or entrained dust. By itself, or in association with other pollutants, TSP, in enough concentration, may injure the respiratory system. TSP also may reduce visibility and contribute to property damage and soiling. A high volume air sampler is used to collect the particles on a glass fibre filter and results are reported as integrated 24-hour concentration of mass of particulate matter per volume of air.

Lead

Lead (Pb) exists in the atmosphere primarily as a particulate resulting from the combustion of leaded gasoline and from certain source industries. Exposure to lead will adversely affect human health (especially young children) by absorption into the bloodstream and impairment of heme synthesis in cells. Other adverse effects associated with elevated blood lead levels include the possibility that nervous system damage may occur. Lead is analyzed from a representative portion of the total suspended particulate collected by high volume sampling. Air concentrations are reported as integrated 24-hour concentrations of mass of lead per volume of air.

Sulphates

Sulphates (SO_4) in the atmosphere are primarily in the form of aerosols such as sulphuric acid and in particulates such as compounds of ammonium and zinc sulphates. Particulate sulphates can arise as a result of hydrogen sulphide oxidation and from sea spray, but are primarily formed from the oxidation of sulphur dioxide. Sulphates can impact on health as small particulate which enter the respiratory system and have been associated as a major contributing factor to visibility reduction. Sulphates are measured as a constituent of total suspended particulate and reported as integrated 24-hour concentrations of mass of sulphate per volume of air.

Nitrates

Nitrates (NO_3) in the atmosphere can be in the form of aerosols, gases, and particulate. The nitrate ion is the most oxidized form of nitrogen and the nitrate salts of all common metals are quite water soluble. Particulate nitrate are believed to contribute to atmospheric haze. Particulate nitrate (and sulphates) may be a major part of dry atmospheric acidic deposition. Nitrate levels are particulate nitrate determined as a constituent of total suspended particulate and are reported as integrated 24-hour concentrations of mass of nitrate per volume of air.

C) SAMPLING SITES

Figure 1 is a map of the urban areas included in the Manitoba Ambient Air Quality Monitoring Network. Figures 2 through 6 depict the monitoring locations within each of the urban centres.

Air monitoring stations are listed in a more detailed form in Table 2 as to location, code number, pollutants monitored, and period during 1986 that monitoring took place.

Table 2: Ambient Air Monitoring Sites (1986)

AREA	CODE	SAMPLING SITE LOCATION	SAMPLE PERIOD	POLLUTANTS MONITORED	TYPE
Winnipeg (Downtown)	9119	65 Ellen Street	Jan. - Dec.	SO ₂ , CO, NO ₂ , O ₃ , COH, TSP, Pb, SO ₄ , NO ₃	NAPS
Winnipeg (Residential)	9118	299 Scotia Street	Jan. - Dec.	SO ₂ , CO, NO ₂ , O ₃ , COH, TSP, Pb, SO ₄ , NO ₃	NAPS
Winnipeg (Roadside)	9102	2120 Portage Avenue	Jan. - Dec.	TSP, Pb, SO ₄ , NO ₃	NAPS
St. Francois Xavier (Winnipeg Background)	4304	MTS Trailer	Jan. - Dec.	TSP, Pb, SO ₄ , NO ₃	
Brandon (Downtown)	9201	11th St. & Princess	Jan. - Dec.	TSP, Pb, SO ₄ , NO ₃	NAPS
Brandon (Industrial)	5131	Assiniboine Community College (Lot)	Jan. - Dec.	NH ₃ , NO ₂ , NO, O ₃ ,	
The Pas	7111	3rd & Ross (Provincial Building)	Jan. - Dec.	H ₂ S (TRS)	
Flin Flon	7233	35 Main Street	Jan. - Dec.	SO ₂	
	7222	Channing Drive	Jan. - Dec.	SO ₂	
Thompson	7344	59 Elizabeth Drive	Jan. - Dec.	SO ₂	

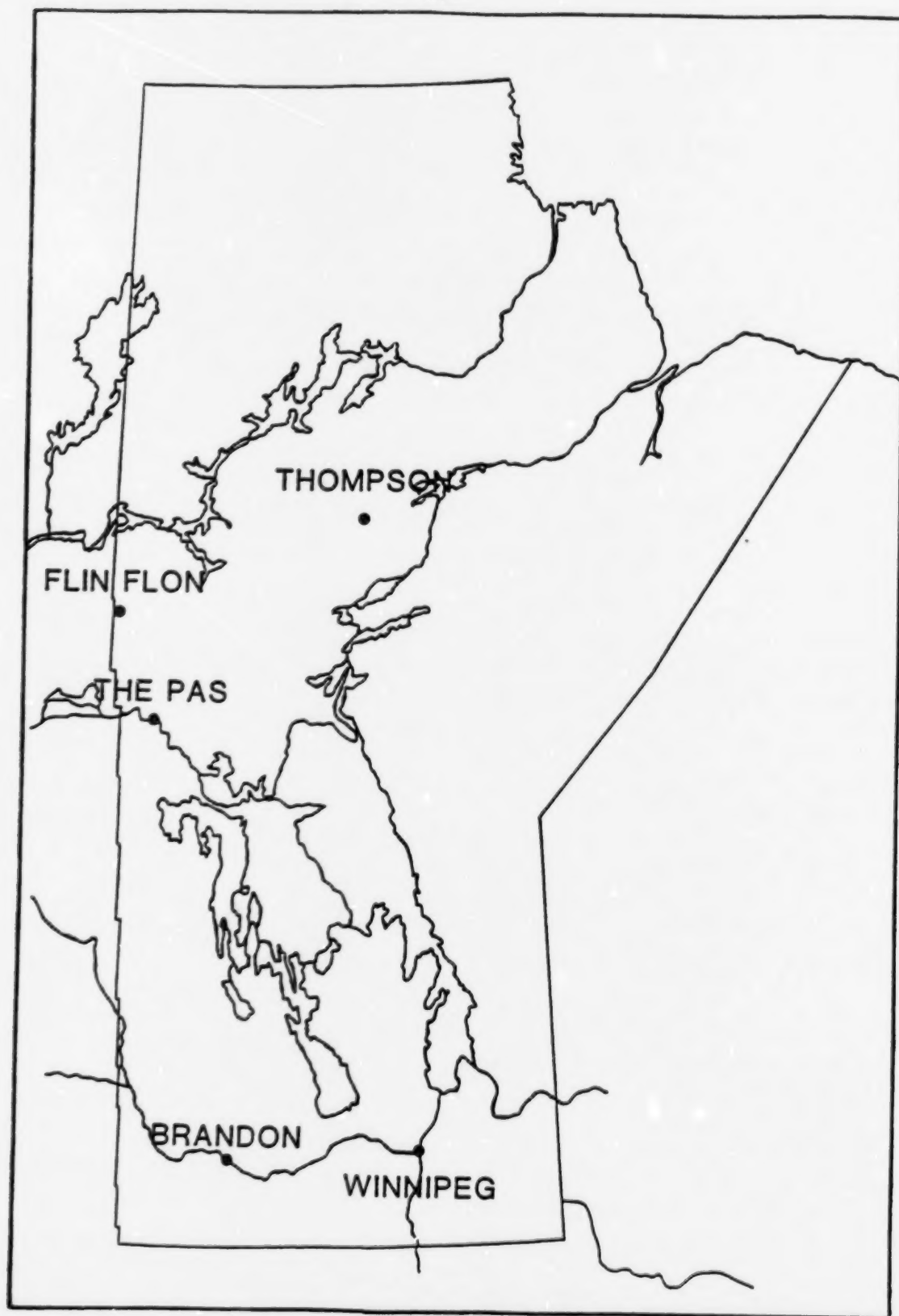


Figure 1

**MANITOBA AMBIENT AIR QUALITY
MONITORING NETWORK**

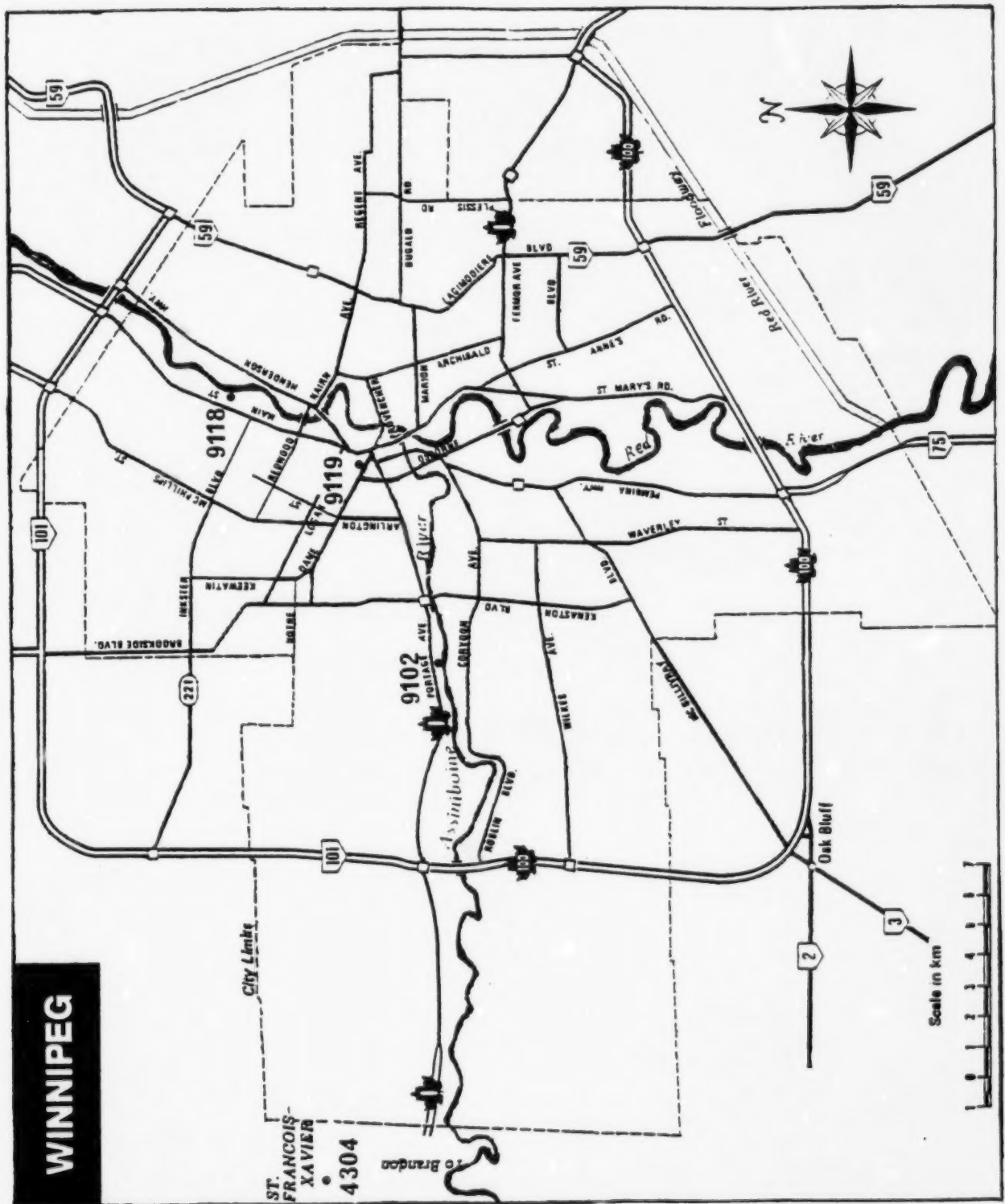


Figure 2

WINNIPEG AMBIENT AIR MONITORING STATIONS

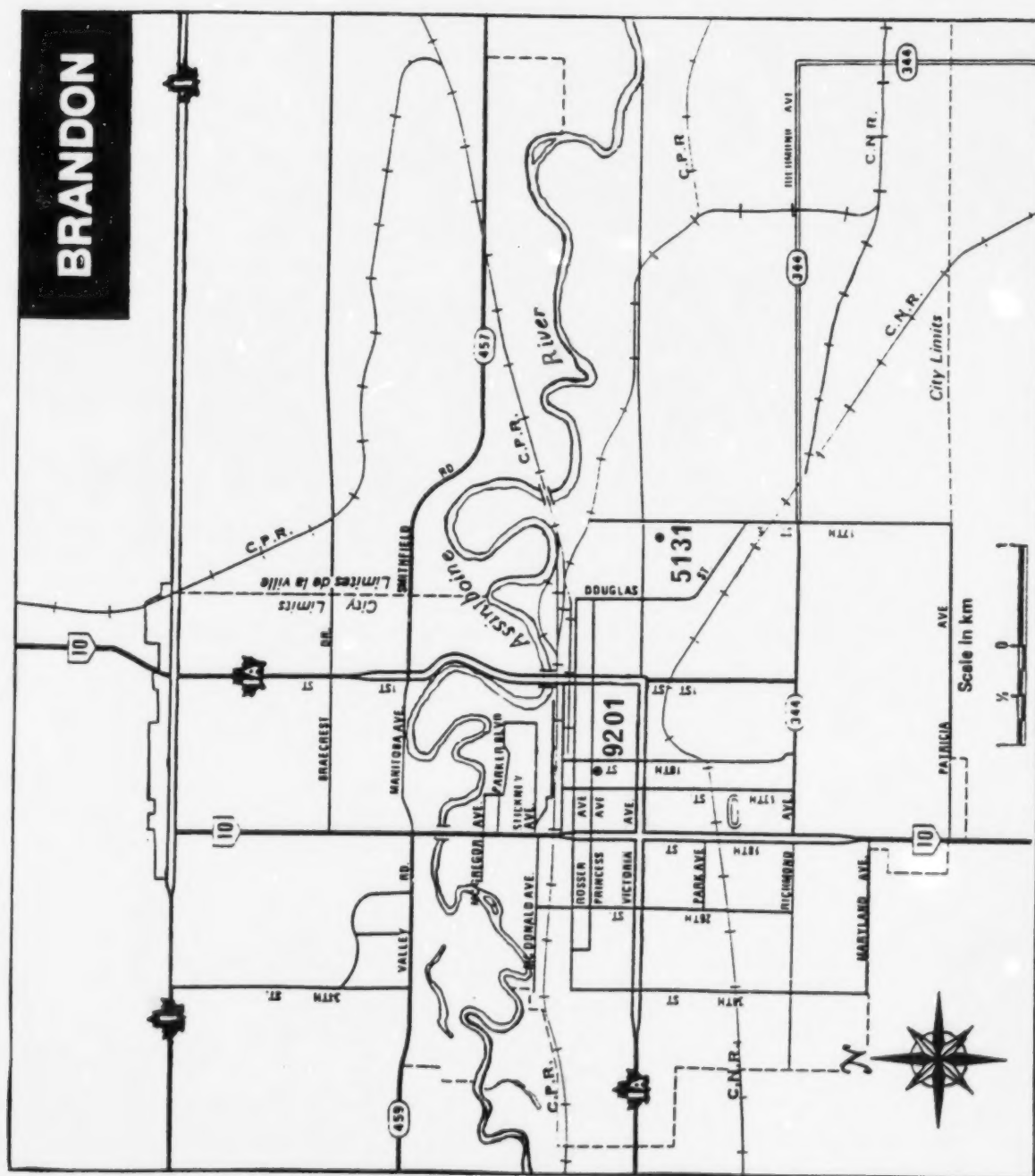


Figure 3 BRANDON AMBIENT AIR MONITORING STATIONS



Figure 4 THE PAS AMBIENT AIR MONITORING STATION

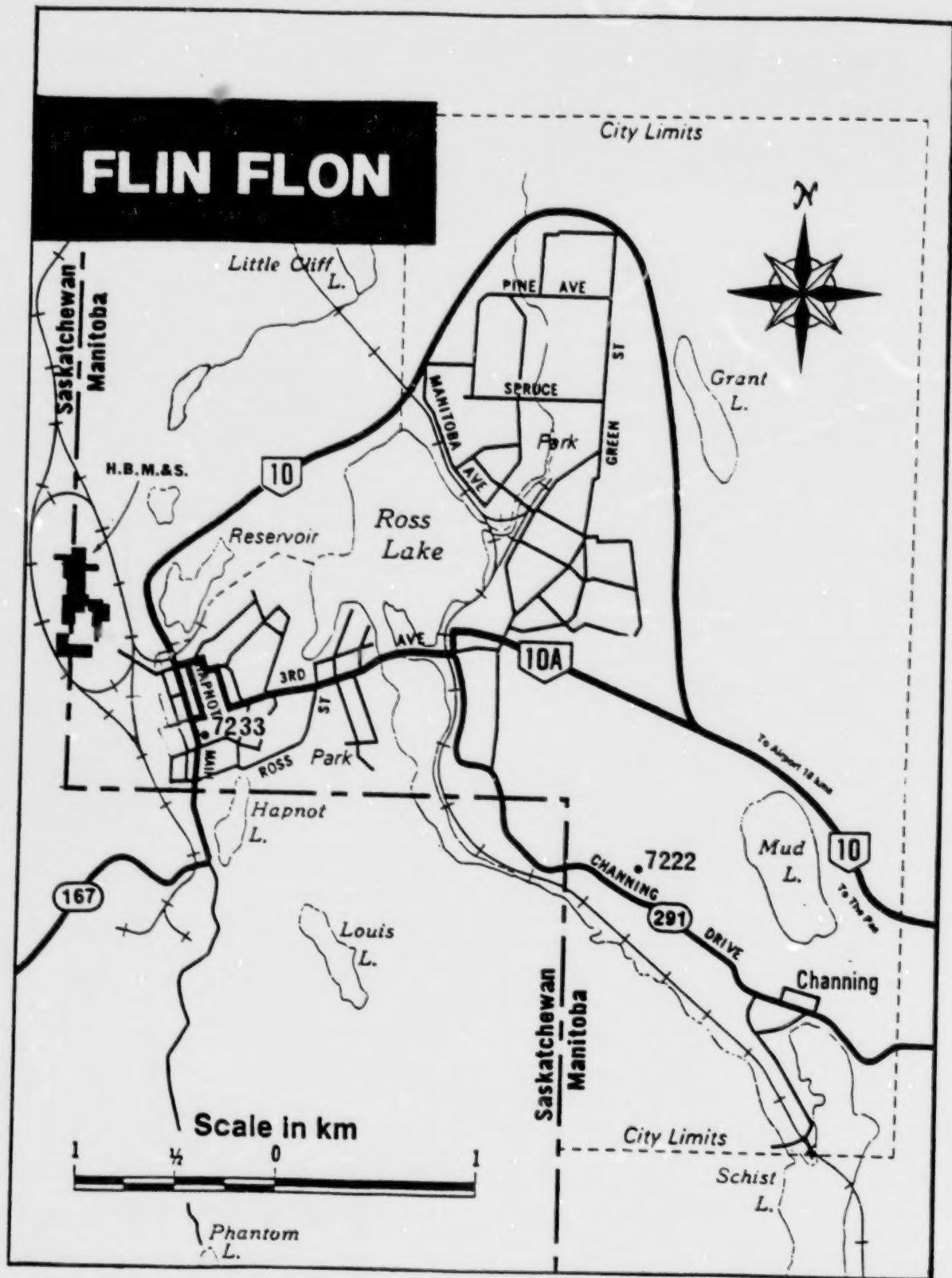


Figure 5

FLIN FLON AMBIENT AIR
MONITORING STATIONS

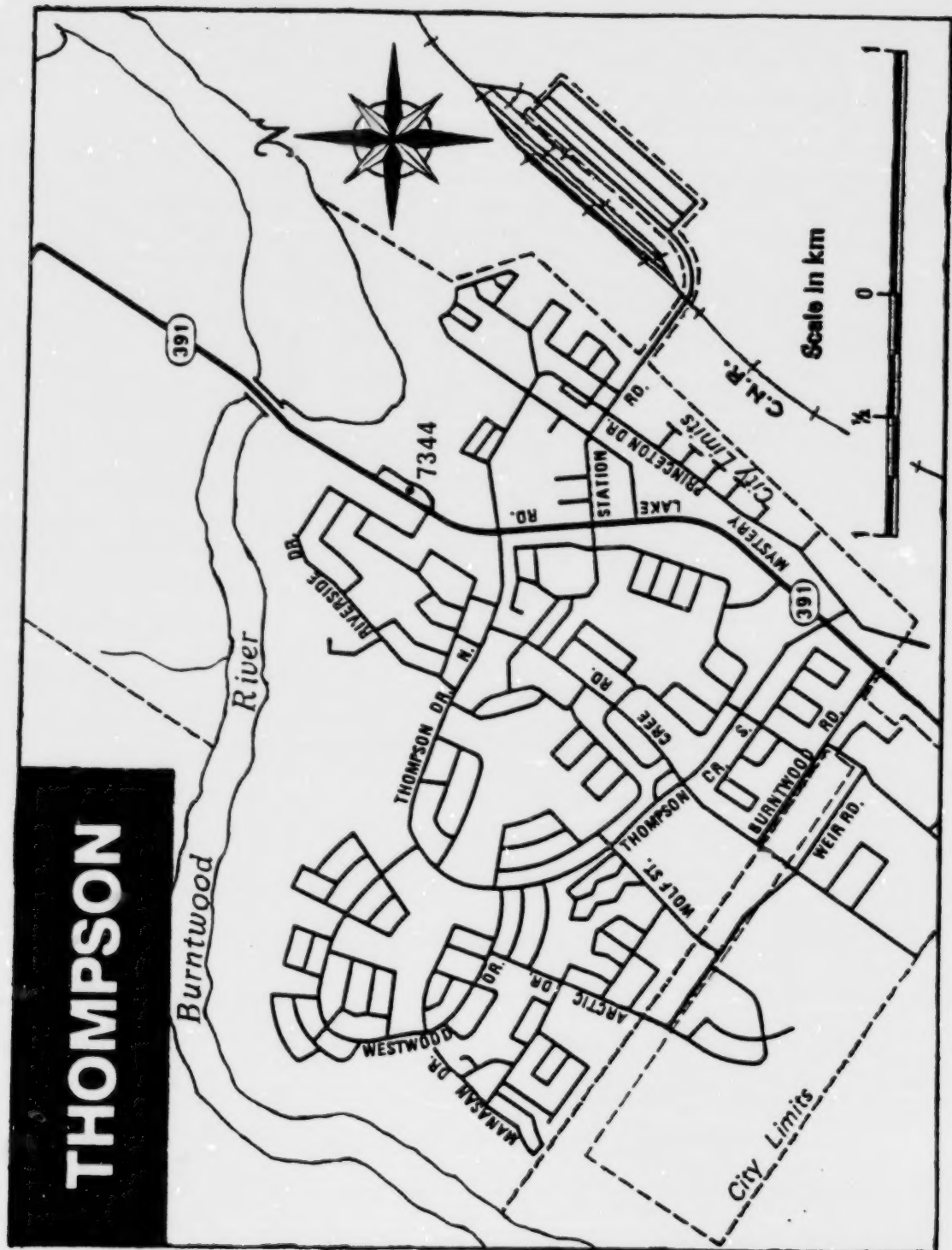


Figure 6

THOMPSON AMBIENT AIR MONITORING
STATION

D) AIR QUALITY INDEX

A Canadian Annual Index of Air Quality has been developed and is used by several jurisdictions to report on air quality.

An air quality index transforms the values of individual air pollution related parameters into a single number or descriptive term in order to:

1. indicate air quality trends
2. permit comparisons of the air quality in different urban areas, and
3. provide a single value indicator of air quality for socio-economic modelling.

Determination of the Index

The concentrations of individual pollutants are converted to a common scale (the pollutant-index scale). The scale is designed such that a value of 0 corresponds to zero concentration, a value of 25 to a concentration equal to the Maximum Desirable Objective, a value of 50 to the Maximum Acceptable Objective, and a value of 100 to the Maximum Tolerable Objective. These points are joined by straight lines. When one or two of the objectives have not been specified for a particular pollutant and averaging time, or the concentration is outside the available objectives, the pollutant-index is determined by linear interpolation or extrapolation.

Using the scale generated above, the 98th percentile concentrations (concentrations exceeded only two (2) per cent of the time) are converted to pollutant-indices.

Where more than one pollutant-index has been computed for a given pollutant, the largest pollutant-index is used to represent that pollutant. The arithmetic mean of the three highest pollutant-indices is then calculated and used as the numerical value of the Canadian Annual Index of Air Quality. The air quality can also be described verbally according to the following scale:

<u>Description</u>	<u>Numerical Values</u>
GOOD	0 - 25
FAIR	26 - 50
POOR	51 - 100
VERY POOR	101 +

The following assumptions have been made in the design and use of this index:

- 1) The index will be based on valid air quality data from monitoring stations that meet the Class 1 requirements of the National Air Pollution Surveillance (NAPS) Network. A Class 1 air quality monitoring station is one where all air quality objective parameters (within reason) are measured continuously. These stations monitor air quality trends and thus require a certain permanency in operation and siting. They serve primarily to evaluate progress in the control of air pollution on a national basis and are fundamentally population oriented.
- 2) At the defined objective levels (Desirable, Acceptable and Tolerable), the effects of all pollutants have equal importance with respect to the quality of the air.

- 3) The index is based on the average of the three (3) different pollutants that have the most significant effect on the environment during a given year. This method was found to best represent actual quality and changes in air quality on an annual basis.
- 4) The index is based on the measured levels of air quality that are not exceeded more than two (2) per cent of the time as recommended by the World Health Organization.

Indices are only presented for stations 9118 (299 Scotia St., Winnipeg), and 9119 (65 Ellen St., Winnipeg) due to the Class 1 requirement.

The site specific indices are listed in Table 6.

RESULTS

EXPLANATION OF DATA STATISTICS

The summary statistics that appear on Tables 3 to 5 are designed to outline, in brief, a profile of annual air pollutant concentration levels at specific sites with comparison to Manitoba Air Quality criteria.

Each pollutant is addressed by name and a unique pollutant number. Immediately below the pollutant is the indication of the units in which the air pollutant concentration levels are reported. Each air sampling site is identified by a station number and location. More information on the specific sampling site can be found by referring to Table 2.

The quantity of data available from which the calculated statistics are drawn is indicated by the two following references:

"# of months of data" - this refers to the number of months in the year for which at least 75% of the data are valid and available (NOT applicable to non-continuous measurements such as TSP, Pb, sulphates, and nitrates).

"Percent of data available" - this refers to the percentage of unit data (e.g. hourly averages) per year that are valid and available.

These two statistics are reflective of representativeness of the data statistics for that year. To representatively reflect annual air quality, two months of each quarter and 75% of the total annual data should be available for statistical calculation.

The "Percentile Distribution" is the data distribution of the unit data as shown (i.e. hourly for most pollutants except bi-hourly for COH, 24-hour integrated samples for TSP, Pb, SO₄ and NO₃). The pth percentile (e.g. 10%) is the pollutant concentration such that p% (e.g. 10%) of the data values are less than that indicated value of pollutant concentration and (100-p)% (e.g. 90%) is greater.

The annual mean is an arithmetic mean (unless otherwise shown) of the available unit data values. The maximum data values are the highest levels present or calculated for the time period listed within the shown year. Other than for the unit data, longer time-based averages are arithmetic and are running averages of consecutive unit data and can overlap for days and/or months. For example, 24-hour running samples are based on increments of one hour and could result in a maximum of $24 \times 31 \times 12 = 8928$ 24-hour sampling periods within a year. At least 75% of the data values within one running period must be available for the calculation of that running mean average.

A comparison of the data to the Manitoba Ambient Air Criteria (Table 1) is shown under the heading "# of samples above M.T.L.," above M.A.L.", et al. This listing is a count of the number of time-based averages or unit data concentrations that are larger than the appropriate time-based objective or guideline level.

In Figures 7 to 22, monthly statistics of unit data for all pollutants (except for total suspended particulate and constituents) are plotted through the course of the year to provide a visual representation of key statistics such as monthly means, maximum concentrations, and 99th percentile concentration levels. In addition, objective and guideline levels are identified. Figures 23 to 42 illustrate actual measured levels of total suspended particulate matter (and constituents) through the course of the year.

TABLE 3:

MANITOBA AMBIENT AIR QUALITY DATA 1986															ANNUAL POLLUTANT SUMMARY														
															1986														
CARBON MONOXIDE (CO), #629 PARTS PER MILLION (PPM)																													
STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR 8-HR	# OF SAMPLES ABOVE M.D.L. 1-HR 8-HR	# OF SAMPLES ABOVE M.A.L. 1-HR 8-HR	# OF SAMPLES ABOVE M.T.L. 1-HR 8-HR															
9118	WINNIPEG, SCOTIA & JEFFERSON	12	92.1	0.0	0.2	0.3	0.5	1.0	3.1	0.5	10.7	5.8	0	1	0														
9119	WINNIPEG, 65 ELLEN STREET	11	89.9	0.3	0.5	0.7	1.0	1.6	3.2	0.8	11.3	5.6	0	10	0														
NITROGEN DIOXIDE (NO ₂), #759 PARTS PER HUNDRED MILLION (PPHM)															1986														
STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR 8-HR	# OF SAMPLES ABOVE M.D.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR 24-HR															
5131	BRANDON, ASSIN. COMMUNITY COLLEGE	11	90.6	0.0	0.3	0.5	0.6	1.7	3.5	0.7	19.0	3.4	0	0	0														
9118	WINNIPEG, SCOTIA & JEFFERSON	12	92.7	0.4	0.8	1.0	1.8	3.1	5.0	1.5	9.0	5.3	0	0	0														
9119	WINNIPEG, 65 ELLEN STREET	10	84.7	0.7	1.3	1.8	2.4	3.6	5.8	2.0	15.1	5.9	0	0	0														
NITRIC OXIDE (NO), #769 PARTS PER HUNDRED MILLION (PPHM)															1986														
STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1 HR 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR 24-HR															
5131	BRANDON, ASSIN. COMMUNITY COLLEGE	11	91.0	0.0	0.2	0.6	0.8	1.4	4.7	0.7	15.3	3.5																	
OXIDANTS (OZONE) (O ₃), #829 PARTS PER HUNDRED MILLION (PPHM)															1986														
STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR 24-HR															
5131	BRANDON, ASSIN. COMMUNITY COLLEGE	12	90.4	0.9	1.9	2.6	3.5	4.6	6.3	2.7	19.5	6.1	466	7091	5														
9118	WINNIPEG, SCOTIA & JEFFERSON	12	91.7	0.4	1.2	2.0	2.7	3.6	5.0	2.0	7.8	4.6	69	5911	0														
9119	WINNIPEG, 65 ELLEN STREET	11	87.5	0.2	0.8	1.6	2.3	3.3	4.8	1.7	7.1	4.2	63	4243	0														
AMMONIA (NH ₃), #789 PARTS PER MILLION (PPM)															1986														
STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR 24-HR	# OF SAMPLES ABOVE 3.0 PPM 1-HR	# OF SAMPLES ABOVE M.A.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR 24-HR															
5131	BRANDON, ASSIN. COMMUNITY COLLEGE	11	86.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	3.6	0.9	2	9															

TABLE 4:

MANITOBA AMBIENT AIR QUALITY DATA 1986

ANNUAL POLLUTANT SUMMARY continued

HYDROGEN SULPHIDE (H₂S), #1619
PARTS PER BILLION (PPB)

1986

STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HR SAMPLES)	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR 24-HR
10%	30%	50%	70%	90%					

7111 THE PAS, PROVINCIAL BLDG.

8 69.1 0 0 0 0 5 0 21 3 7 0 0

SULPHUR DIOXIDE (SO₂), #1629
PARTS PER MILLION (PPM)

1986

STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HR SAMPLES)	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR 24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR 24-HR
10%	30%	50%	70%	90%					

9118 WINNIPEG, SCOTIA & JEFFERSON

11 90.2 0.00 0.00 0.00 0.00 0.04 0.00 0 0 0 0

9119 WINNIPEG, 65 ELLEN STREET

11 90.0 0.00 0.00 0.00 0.00 0.07 0.01 0 0 0 0

7233 FLIN FLOW, 35 MAIN STREET

12 95.1 0.00 0.00 0.00 0.00 0.85 0.11 72 80 15 0 0

7222 FLIN FLOW, CHANNING DRIVE

12 94.9 0.00 0.00 0.00 0.00 0.83 0.11 50 77 11 0 0

7344 THOMPSON, 59 ELIZABETH DRIVE

12 92.3 0.00 0.00 0.00 0.00 0.66 0.13 98 243 27 32 0

SOILING INDEX (SMOKE), #9709
COEFFICIENT OF HAZE UNITS PER 1000 FEET (CON)

1986

STATION NUMBER	STATION LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (2-HR SAMPLES)	ANNUAL MEAN	MAXIMUM DATA VALUES 2-HR 24-HR	# OF SAMPLES ABOVE M.D.L. 2-HR 24-HR	# OF SAMPLES ABOVE M.A.L. 2-HR 24-HR	# OF SAMPLES ABOVE M.T.L. 2-HR 24-HR
10%	30%	50%	70%	90%					

9118 WINNIPEG, SCOTIA & JEFFERSON

10 91.3 0.0 0.0 0.0 0.1 0.2 0.6 0.1 2.1 0.9 30 0 0

9119 WINNIPEG, 65 ELLEN STREET

10 43.6 0.0 0.1 0.1 0.2 0.3 0.8 0.2 2.3 0.9 50 0 0

TOTAL SUSPENDED PARTICULATE (TSP), #1089
MICROGRAMS PER CUBIC METRE (ug/m³)

1986

STATION NUMBER	STATION LOCATION	# OF SAMPLES	PERCENTILE DISTRIBUTION (24-HR INTEGRATED)	ANNUAL GEOMETRIC MEAN	MAXIMUM DATA VALUES 24-HOUR	# OF SAMPLES ABOVE M.A.L. 24-HOUR	# OF SAMPLES ABOVE M.T.L. 24 HOUR
10%	30%	50%	70%	90%			

4304 ST. FRANCOIS XAVIER, HTS TRAILER (Background)

53 8 12 20 29 52 82 19 86 0 0

9102 WINNIPEG, 2120 PORTAGE AVENUE

54 19 32 40 49 66 95 37 109 0 0

9116 WINNIPEG, 299 SCOTIA STREET

55 13 19 25 40 62 95 27 119 0 0

9119 WINNIPEG, 65 ELLEN STREET

210 24 37 56 87 132 216 57 267 29 0

9201 BRANDON, 1104 PRINCESS AVENUE

56 11 18 31 50 73 128 28 163 1 0

TABLE 5

MANITOBA AMBIENT AIR QUALITY DATA

ANNUAL POLLUTANT SUMMARY continued

LEAD (Pb), #8219 MICROGRAMS PER CUBIC METRE ($\mu\text{g}/\text{m}^3$)										1986	
STATION NUMBER	STATION LOCATION	PERCENT OF DATA AVAILABLE	PERCENTILE DISTRIBUTION (24-HR INTEGRATED)				ANNUAL GEOMETRIC MEAN	MAXIMUM DATA VALUES 24-HOUR	# OF SAMPLES ABOVE M.A.L. 24-HOUR		
			10%	30%	50%	70%	90%				
4304	ST. FRANCOIS XAVIER, MTS TRAILER (Background)	86.9	0.03	0.03	0.03	0.03	0.05	0.15	0		
9102	WINNIPEG, 2120 PORTAGE AVENUE	88.5	0.04	0.07	0.10	0.16	0.31	1.01	0		
9118	WINNIPEG, 299 SCOTIA STREET	90.2	0.03	0.05	0.07	0.08	0.15	0.33	0		
9119	WINNIPEG, 65 ELLEN STREET	93.4	0.04	0.09	0.11	0.14	0.20	0.39	0		
9201	BRANDON, 1104 PRINCESS AVENUE	90.3	0.03	0.05	0.06	0.08	0.13	0.19	0		
							0.05	0.24	0		
SULFATES (SO_4), #1639											
MICROGRAMS PER CUBIC METRE ($\mu\text{g}/\text{m}^3$)											
STATION NUMBER	STATION LOCATION	PERCENT OF DATA AVAILABLE	PERCENTILE DISTRIBUTION (24-HR INTEGRATED)				ANNUAL GEOMETRIC MEAN	MAXIMUM DATA VALUES 24-HOUR	# OF SAMPLES ABOVE M.A.L. 24-HOUR		
			10%	30%	50%	70%	90%				
4304	ST. FRANCOIS XAVIER, MTS TRAILER (Background)	86.9	0.4	0.8	1.2	1.6	2.9	5.7	0		
9102	WINNIPEG, 2120 PORTAGE AVENUE	88.5	0.8	1.0	1.6	2.0	3.2	9.9	0		
9118	WINNIPEG, 299 SCOTIA STREET	90.2	0.5	1.2	1.5	2.2	3.4	5.4	0		
9119	WINNIPEG, 65 ELLEN STREET	93.4	1.1	1.6	2.0	2.6	4.5	9.7	0		
9201	BRANDON, 1104 PRINCESS AVENUE	90.3	0.4	0.9	1.3	1.7	2.4	6.6	0		
							1.1	7.7	0		
NITRATES (NO_3), #0779											
MICROGRAMS PER CUBIC METRE ($\mu\text{g}/\text{m}^3$)											
STATION NUMBER	STATION LOCATION	PERCENT OF DATA AVAILABLE	PERCENTILE DISTRIBUTION (24-HR INTEGRATED)				ANNUAL GEOMETRIC MEAN	MAXIMUM DATA VALUES 24-HOUR	# OF SAMPLES ABOVE M.A.L. 24-HOUR		
			10%	30%	50%	70%	90%				
4304	ST. FRANCOIS XAVIER, MTS TRAILER (Background)	86.9	0.2	0.4	0.7	1.0	2.2	6.4	0		
9102	WINNIPEG, 2120 PORTAGE AVENUE	88.5	0.3	0.6	0.9	1.4	2.8	7.4	0		
9118	WINNIPEG, 299 SCOTIA STREET	90.2	0.3	0.5	0.9	1.2	3.0	7.6	0		
9119	WINNIPEG, 65 ELLEN STREET	93.4	0.2	0.6	1.0	1.4	3.1	8.2	0		
9201	BRANDON, 1104 PRINCESS AVENUE	90.3	0.1	0.4	0.6	0.9	1.5	6.0	0		
							0.5	7.2	0		

Table 6: 1986 Air Quality Indices

Station Code and Location	Pollutant	Averaging Time	98th %	Sub Pollutant Index	Descriptor	Station Mean
9118 299 Scotia St. Winnipeg	CO	1-hr.	2.4 ppm	4.7	Good	19.8 Good
	CO	8-hr.	1.9 ppm	9.2	Good	
	NO2	1-hr.	4.5 pphm	10.6	Good	
	NO2	24-hr.	3.6 pphm	16.9	Good	
	O3	1-hr.	4.7 pphm	23.5	Good	
	TSP	24-hr.	175 µg/m ³	19	Good	
	SO2	1-hr.	0.00 ppm	0	Good	
	SO2	24-hr.	0.1 pphm	0.5	Good	
9119 65 Ellen St. Winnipeg	CO	1-hr.	2.6 ppm	5.0	Good	36.1 Fair
	CO	8-hr.	2.1 ppm	10.2	Good	
	NO2	1-hr.	5.2 pphm	12.2	Good	
	NO2	24-hr.	4.4 pphm	20.7	Good	
	O3	1-hr.	4.5 pphm	22.5	Good	
	TSP	24-hr.	203 µg/m ³	65	Poor	
	SO2	1-hr.	0.00 ppm	0	Good	
	SO2	24-hr.	0.3 pphm	1.4	Good	

DISCUSSION

Though it was the intent within the design of the sampling network to locate monitoring sites in accord with generally-accepted siting criteria and to use collection and analytical procedures that are common to other networks, it should be noted that the data presented in this report may have limitations and, therefore, caution should be exercised towards its use. In particular, when comparing data between Canadian regions and even between stations in the same city, it must be realized that the data represents the condition of the air in the vicinity of the individual monitoring station and may not necessarily reflect community-wide air quality.

A. WINNIPEG AIR QUALITY

DOWNTOWN:

Air quality in the downtown area of Winnipeg was represented by monitoring at station 9119, 65 Ellen Street, a NAPS Class 1 site, in 1986. Measurements were made for the pollutants sulphur dioxide, carbon monoxide, nitrogen dioxide, ozone, soiling index, total suspended particulate matter, lead, sulphates, and nitrates.

Sulphur dioxide (SO_2) levels downtown during 1986 continued to be low as in previous years and at undetectable or trace concentrations. No levels above any of the Provincial criteria were recorded. The highest 1-hour measured concentration level was 0.07 ppm; the highest 24-hour average was 0.01 ppm.

Carbon monoxide (CO) levels at station 9119 were similar to levels measured in 1985 though maximum data levels had decreased significantly to 11.3 ppm for the 1-hour average (from 14.6 in 1985) and to 5.6 ppm for the 8-hour average (from 10.5 in 1985). The 8-hour MDL criteria of 5.0 ppm was exceeded ten times at this site during the months of January, February and October, a decreased frequency compared to 1985. None of the other criteria were exceeded at this site in 1986. Averaged levels of CO in the downtown area were higher than those observed in the residential area even though maximum 1-hour and 8-hour readings were similar (Figures 7 and 8).

Nitrogen dioxide (NO₂) levels at downtown Winnipeg continued to be well below the Manitoba Air Quality Objectives. The maximum values recorded were 0.15 ppm for the 1-hour, and 0.059 ppm for the 24-hour time periods; these levels were similar to the levels observed in previous years at this location (Figure 10).

Ozone (O₃) levels in downtown Winnipeg were the lowest of all sites in Manitoba that monitored for ozone (Figures 12, 13 and 14). No levels were above the 1-hour MAL though frequent excursions, as in previous years, continued to be measured above the 1-hour MDL of 0.05 ppm and both the 24-hour MDL and MAL of 0.015 ppm and 0.025 respectively. The maximum 1-hour ozone value was 0.071 ppm and the maximum 24-hour value was 0.042 ppm; both of these levels are similar to maximums recorded in 1985.

Soiling index values were measured as Coefficient of Haze (COH) units per 1000 feet for a 2-hour sampling period. Levels at the downtown site were similar to levels found at the residential site (Figures 15 and 16) and also similar to levels recorded in the downtown

during 1985. The maximum 2-hour level recorded was 2.3 COH units and the maximum 24-hour value was 0.9 COH units, both occurring at the downtown site in the month of October. During the year, the 24-hour MDL was exceeded 50 times at the downtown site, most of these occurred in the month of October; a majority of these levels seem to be related to smoke-in-air from agricultural burning.

Total suspended particulate (TSP) levels in downtown Winnipeg (Figure 24) were the highest of all sites (similar to observations in previous years). During 1986, this site was the only one where sampling was performed at an enhanced frequency (210 days samples) whereas all other TSP sites were sampled at the standard NAPS cycle (once every sixth day as per a documented schedule). This enhanced sampling may be providing greater resolution that is not identified at the other sites operating at the standard sampling frequency. The annual geometric mean at this site was $57 \mu\text{g}/\text{m}^3$ and was below both the annual MDL and MAL air quality criteria of $60 \mu\text{g}/\text{m}^3$ and $70 \mu\text{g}/\text{m}^3$ respectively. The maximum 24-hour level recorded was $267 \mu\text{g}/\text{m}^3$ on April 04 during the early spring when elevated dust levels are not uncommon and arise primarily from vehicle-entrained dust from city streets before a thorough street cleaning program can be completed to remove grit spread on the streets during the winter season for safety purposes. Several other elevated levels were recorded within the above time period. Of the total samples collected, 29 (14%) exceeded the 24-hour MAL of $120 \mu\text{g}/\text{m}^3$. In comparison to 1985, TSP levels in the downtown area appear to have significantly decreased with regard to annual mean, maximum recorded level, and exceedences of criteria.

Lead (Pb) levels within the downtown area (Figure 29) were well below the 24-hour MAL of 5.0 micrograms per cubic metre. The average geometric mean of $0.10 \mu\text{g}/\text{m}^3$ is lower than 1985 (0.16) and the maximum 24-hour level of $0.45 \mu\text{g}/\text{m}^3$ is similar to 1985.

Sulphate (SO_4) levels at 9119 (Figure 34) had an annual average of $2.1 \mu\text{g}/\text{m}^3$ as a 24-hour average with a maximum of $10.9 \mu\text{g}/\text{m}^3$. These levels are similar to those recorded in previous years at this location. There are no Manitoba Air Quality Guidelines nor Objectives for sulphates.

Nitrate (NO_3) concentrations at all Winnipeg sites (Figures 38, 39 and 40) are similar. The annual mean at station 9119 was $0.9 \mu\text{g}/\text{m}^3$ as a 24-hour average (a slight increase from 1985's mean of 0.7). The maximum 24-hour level was $11.0 \mu\text{g}/\text{m}^3$ (a significant increase from 1985's maximum level of 3.9). As with sulphates, there are no Manitoba Air Quality Guidelines nor Objectives for nitrates.

Based on the Canadian Annual Air Quality Index, air quality in downtown Winnipeg is rated as being FAIR, with a pollutant index value of 36.1 (Table 6). This rating is similar to that determined in previous years (1983-1985). The main contributor to the fair ratings in all years was the 24-hour total suspended particulate levels, which were poor; all other pollutant sub-indices were in the good range.

RESIDENTIAL:

The description of Winnipeg residential air quality is based on sampling conducted at station 9118 (299 Scotia Street), a NAPS Class 1 site. The same parameters as in the downtown site are monitored at this location.

Sulphur dioxide (SO_2) concentrations in the residential area of Winnipeg continue to be well below ambient air quality objectives at undetectable or trace levels. The maximum 1-hour level at this site was 0.04 ppm and maximum 24-hour average was below detection (reported as 0.00 ppm). These measured levels are similar to previous years and indicate background levels.

Carbon monoxide (CO) levels at 9118, on average, are slightly lower than those in the downtown area (0.5 and 0.8 ppm annual averages, respectively) though maximum levels are similar (10.7 ppm 1-hour and 5.8 ppm 8-hour at 9118) (Figures 7 and 8). Only 1 excursion of the 8-hour MDL was recorded at this location.

Nitrogen dioxide (NO_2) levels at 9118 are similar to those measured in the downtown area (Figures 9 and 10). The maximum 1-hour level recorded was 0.09 ppm and the maximum 24-hour level was 0.053 ppm. All recorded levels were below the air quality criteria.

Ozone (O_3) levels at site 9118 (Figure 12) appear to be somewhat higher than in the downtown area. The maximum 1-hour level recorded was 0.078 ppm and 0.042 ppm as a 24-hour average. The 1-hour MAL was not exceeded at this location. The frequent excursions above the 1-hour MDL and the 24-hour criteria (both MDL and MAL) are present at this location as with other sites. In general, levels at this location during 1986 appear to be somewhat higher than those observed in 1985.

Soiling Index (COH) levels at 9118 (Figure 15) on average, are lower than in the downtown area even though maximum 2-hour and 24-hour values are similar; also, levels in 1986 in this residential area are somewhat higher than those recorded in 1985. In 1986, thirty

24-hour averages were above the 24-hour MDL, most of which occurred in October. Again, the cause is thought to be related to smoke-in-air from agricultural burning. The maximum 2-hour level was 2.1 COH and the maximum 24-hour average was 0.9 COH, both occurring in October.

Total suspended particulate (TSP) matter levels at 9118 (Figure 23) were significantly lower than in the downtown area and also have decreased in comparison to 1985. This observation may be partially accounted by the decreased sampling frequency (in comparison to 1985) and, therefore, a coarser resolution of actual levels present in the area. The maximum 24-hour reading at 9118 was $119 \mu\text{g}/\text{m}^3$; all levels were below the 24-hour MAL. The annual geometric mean of $27 \mu\text{g}/\text{m}^3$ was well below both the annual MDL and MAL criteria level.

Lead (Pb) levels at 9118 (Figure 28) were well below the 24-hour air quality criteria. The maximum 24-hour level was $0.37 \mu\text{g}/\text{m}^3$. In general, readings were similar to previous years at this location and appeared to be lower than in the downtown and roadside areas.

Sulphate (SO_4) and nitrate (NO_3) concentration levels at 9118 were, generally, similar to levels measured in other areas of the city. No air quality guidelines have been promulgated for protection to receptors.

Winnipeg residential air quality as measured at station 9118 rates a Pollutant Index value of 19.8 or GOOD. This represents an improvement in air quality from both 1984 and 1985 where the ratings were fair. This change can be attributed specifically to decreases in the concentration levels of total suspended particulate matter present in the air.

ROADSIDE:

Air quality in the vicinity of areas with high density traffic is represented by data from site 9102 (NAPS Class 2) where monitoring was conducted for total suspended particulate matter and these further analyzed for lead, sulphates and nitrates.

Total suspended particulate (TSP) levels (Figure 25) at 9102 are lower than those at the downtown area but somewhat higher than the residential and other areas. The annual geometric average of $37 \mu\text{g}/\text{m}^3$ (compared to $42 \mu\text{g}/\text{m}^3$ in 1985) is lower than both the MDL and MAL criteria. The maximum 24-hour level at this site was $109 \mu\text{g}/\text{m}^3$; no levels exceeded the 24-hour MAL unlike in 1985 when 6% of the levels were elevated.

Lead (Pb) levels (Figure 30) at 9102, as in 1985, were very similar to those encountered in the downtown area. The annual geometric mean was $0.11 \mu\text{g}/\text{m}^3$ as a 24-hour ($0.16 \mu\text{g}/\text{m}^3$ in 1985). The highest lead level of all sites was recorded at 9102 ($1.31 \mu\text{g}/\text{m}^3$), but all levels were well below the Manitoba air quality guideline for lead of $5.0 \mu\text{g}/\text{m}^3$.

Sulphates and nitrates at 9102 were similar to those at other Winnipeg sites.

BACKGROUND:

Background levels of total suspended particulate (TSP) matter (and analysis for lead, sulphates and nitrates) are monitored at station 4304 in St. Francois Xavier, a small hamlet located approximately 7 kilometres west of Winnipeg's city limits. TSP levels

at this site (Figure 26) showed a lower annual mean ($19 \mu\text{g}/\text{m}^3$) than the overall mean of all Winnipeg sites ($37.1 \mu\text{g}/\text{m}^3$). This statistic is similar to that observed in 1985 where, on average, it would appear that background levels are about one-half the level of those in Winnipeg. The maximum 24-hour level measured at 4304 was $86 \mu\text{g}/\text{m}^3$; all levels were below the 24-hour MAL criteria level.

Lead (Pb) levels at St. Francois Xavier (Figure 31) were significantly lower than those within Winnipeg. The annual mean at this background site was $0.04 \mu\text{g}/\text{m}^3$ compared to the overall mean at Winnipeg sites of $0.09 \mu\text{g}/\text{m}^3$. The maximum 24-hour level measured was $0.16 \mu\text{g}/\text{m}^3$. All levels were below the 24-hour MAL for lead.

Sulphates and nitrates levels at 4304, on average, are lower than those at the Winnipeg stations but similar to those measured in Brandon. The annual average at 4304 for sulphates was $1.2 \mu\text{g}/\text{m}^3$ compared to the Winnipeg overall average of $1.6 \mu\text{g}/\text{m}^3$; the background nitrate level was $0.6 \mu\text{g}/\text{m}^3$ compared to the overall average of Winnipeg site of $0.8 \mu\text{g}/\text{m}^3$.

B. BRANDON AIR QUALITY

DOWNTOWN:

Air quality in downtown Brandon is sampled at station 9201 (1104 Princess Avenue), A NAPS Class 2 site, for total suspended particulate (TSP) matter and further analyzed for lead, sulphates and nitrates. TSP levels at this site (Figure 27) are similar to those in the Winnipeg residential area (9118). The annual average of 28

$\mu\text{g}/\text{m}^3$ is somewhat lower than that recorded in 1985 ($31 \mu\text{g}/\text{m}^3$).

The maximum 24-hour level was $163 \mu\text{g}/\text{m}^3$ recorded on April 8; this one elevated level was the only measurement out of the 56 samplings days to exceed the 24-hour MAL of $120 \mu\text{g}/\text{m}^3$.

Lead (Pb) levels in downtown Brandon (Figure 32) appear to be between those measured at Winnipeg's background site and the Winnipeg residential area. The maximum 24-hour level recorded was $0.24 \mu\text{g}/\text{m}^3$ with an annual mean of $0.05 \mu\text{g}/\text{m}^3$; all readings are well below the Provincial air quality guideline for lead.

Sulphate and nitrate levels in downtown Brandon are similar to those measured at St. Francois Xavier (4304).

INDUSTRIAL:

Air quality in the east industrial part of Brandon is monitored at station 5131 for nitrogen oxides, ozone, and ammonia. The monitoring site is located on the grounds of the Assiniboine Community College.

Nitrogen dioxide (NO_2) levels at station 5131 (Figure 11) appeared to be lower than those measured at the Winnipeg sites though maximum readings at 5131 (0.19 ppm 1-hour, 0.034 ppm 24-hour) were similar to Winnipeg's. No levels at 5131 exceeded the MAL criteria levels. Nitric oxide (NO) concentrations were also monitored at 5131 although no Manitoba Air Quality Guidelines or Objectives have been formulated. The mean was 0.007 ppm with maximum values of 0.153 ppm (1-hour) and 0.035 (24-hour).

Ozone (O_3) levels at station 5131 (Figure 14) were the highest of all sites including the Winnipeg area. Five 1-hour samples exceeded the 1-hour MAL. Frequent exceedences were recorded above the 1-hour MDL and the 24-hour time-based criteria. The maximum data values were 0.195 ppm (1-hour) and 0.061 ppm (24-hour). Several elevated hourly readings (including the above maximum) were recorded in the late afternoon of May 05. Though meteorological conditions were unstable in the morning (showers, thunderstorms, gusty winds), the source of these levels are unknown (Atkinson, 1987).

Ammonia (NH_3) monitoring at station 5131 (Figure 17) is emission source-specific for emissions (if any) from a fertilizer manufacturer. Background levels of ammonia are undetectable and reported as being 0.0. The maximum recorded levels at this site were 3.6 (1-hour) and 0.9 ppm (24-hour). The Manitoba MAL guideline of 2.0 ppm ammonia for any one hour period was exceeded on nine occasions (37 in 1985) (Figure 18). The Manitoba Clean Environment Commission regulatory limit issued to the fertilizer company of 3 ppm as a 1-hour average was exceeded on only two occasions. In comparison to previous years, a marked decrease in ammonia-in-air levels have been recorded at this site.

C. THE PAS AIR QUALITY

Hydrogen sulphide (H_2S) was the only air quality parameter measured in The Pas. The monitoring was conducted at the Provincial Building at the intersection of 3rd Street and Ross Avenue in the downtown area. The primary source of H_2S (and other reduced

sulphurs) in the community is a kraft pulp and paper mill located approximately 5 kilometers NE from the town. Annual emissions of total reduced sulphurs have been previously estimated to be about 1 kilotonne per year (Air Standards and Studies, 1988).

H₂S levels recorded at this site are normally at undetectable concentrations (<3 ppb) and are reported as 0.0. During 1986, there were 7 one-hour values above the MAL of 11 ppb but no averages were calculated to be above the 24-hour MAL of 4 ppb. The maximum data values were 21 ppb (1-hour) and 3 ppb (24-hour average).

D. FLIN FLON AIR QUALITY

Sulphur dioxide (SO₂) is monitored in Flin Flon by the Province at two locations: a) Site 7233 located in downtown Flin Flon at 35 Main Street, and b) Site 7222 located at Channing Drive near the outskirts of town. The primary source of SO₂ in Flin Flon is a major zinc-copper smelter located in the downtown area straddling the Manitoba-Saskatchewan border. Reported emissions for 1986 from this complex is 256,607 tonnes (Schultz 1987). In addition to the Provincial sites, three monitoring sites are operated and reported on by the above Company.

Sulphur dioxide levels (Figures 19 and 20) measured at both of the Provincial sites appear to be similar to one another, as observed in 1985, but unlike earlier years where levels at the downtown area have appeared to be higher (Regehr 1985). As would be expected about an emission source, most hourly levels are undetectable and reported to be 0.00 ppm (background levels). The annual average

at the downtown site, 7233, was 0.01 ppm and at 7222, the average was 0.00 ppm. In the downtown area, 15 1-hour levels and no 24-hour averages were above the MAL criteria. At the Channing site, 11 1-hour levels and no 24-hour averages exceeded the MAL. A somewhat higher frequency of exceedences above the MDL criteria were observed at both sites. In comparison to 1985, a lower exceedence frequency was observed for both sites and for all criteria.

The maximum data values downtown were 0.85 ppm (1-hour) and 0.11 ppm (24-hour); at Channing, the maximum levels were 0.83 ppm (1-hour) and 0.11 ppm (24-hour).

E. THOMPSON AIR QUALITY

Sulphur dioxide (SO_2) is the only pollutant monitored in Thompson by the Province. The one site (7344) is located within the Thompson Provincial Building (59 Elizabeth Road) at a distance of about 2.9 kilometres from a major nickel-copper smelter located south of the town. Reported SO_2 emissions from this complex during 1986 were 219,101 tonnes (Schultz 1987). An additional air monitoring station to measure SO_2 is also maintained by the Company within the City of Thompson.

During 1986, 27 1-hour and 32 24-hour averages were recorded above the Provincial MAL criteria. A significantly higher frequency of exceedences above the MDL criteria were observed. The maximum data levels were 0.66 (1-hour) and 0.13 (24-hour). SO_2 levels during 1986 appear to be similar to those observed in 1985.

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- Regehr, D. Manitoba Ambient Air Quality Annual Report - 1983. Manitoba Environment and Workplace Safety and Health, January, 1985.
- Regehr, D. Manitoba Ambient Air Quality Annual Report - 1984. Manitoba Environment and Workplace Safety and Health, November, 1985.
- Schultz, A. Manitoba Environment and Workplace Safety and Health. Private communication. 1987.

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APPENDIX

CARBON MONOXIDE (CO) WINNIPEG, SCOTIA & JEFFERSON #9118 1-Hour Samples

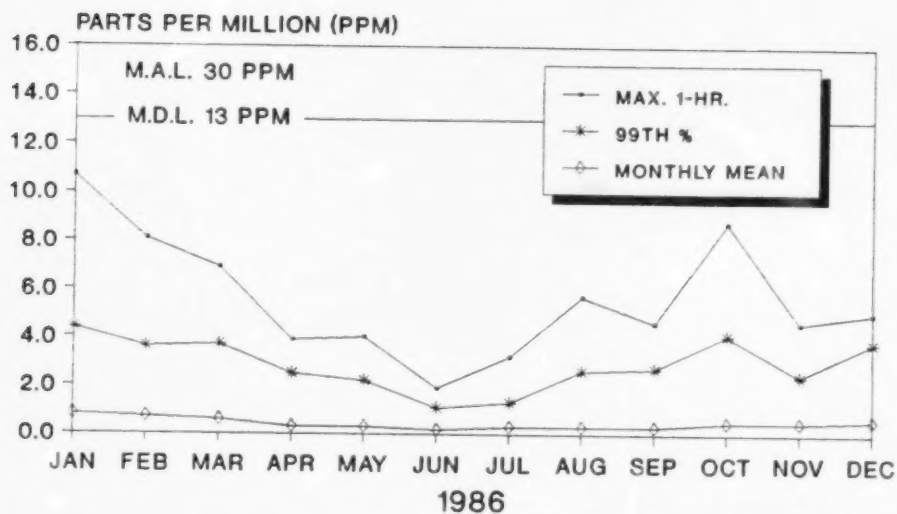


Figure 7

CARBON MONOXIDE (CO) WINNIPEG, 65 ELLEN ST. #9119 1-Hour Samples

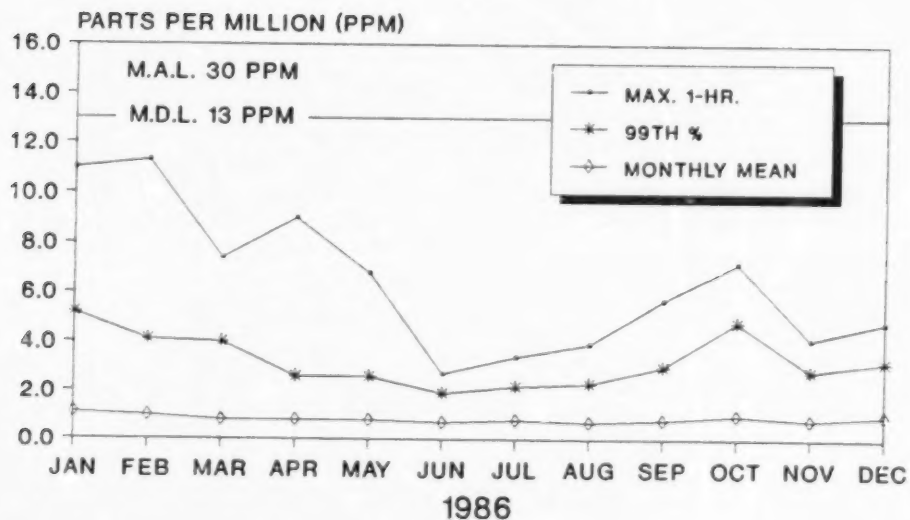


Figure 8

NITROGEN DIOXIDE (NO₂) **WINNIPEG, SCOTIA & JEFFERSON #9118** **1-Hour Samples**

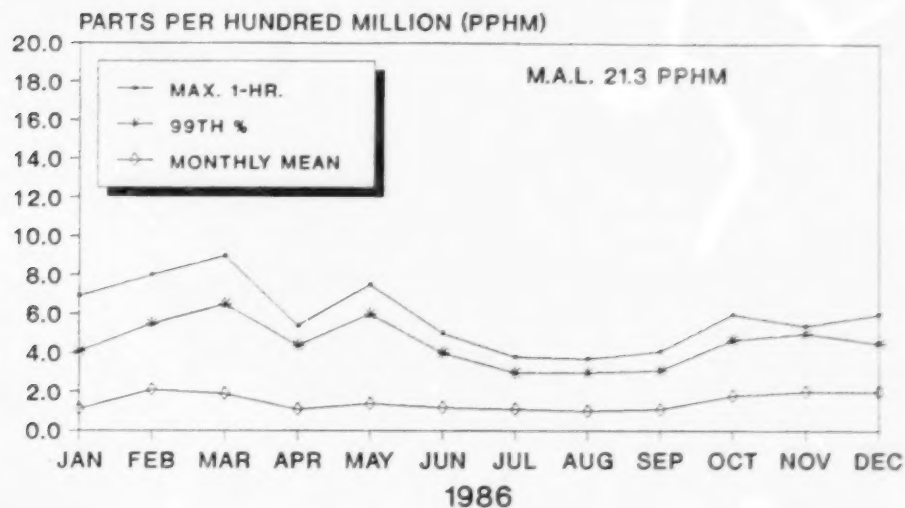


Figure 9

NITROGEN DIOXIDE (NO₂) **WINNIPEG, 65 ELLEN ST. #9119** **1-Hour Samples**

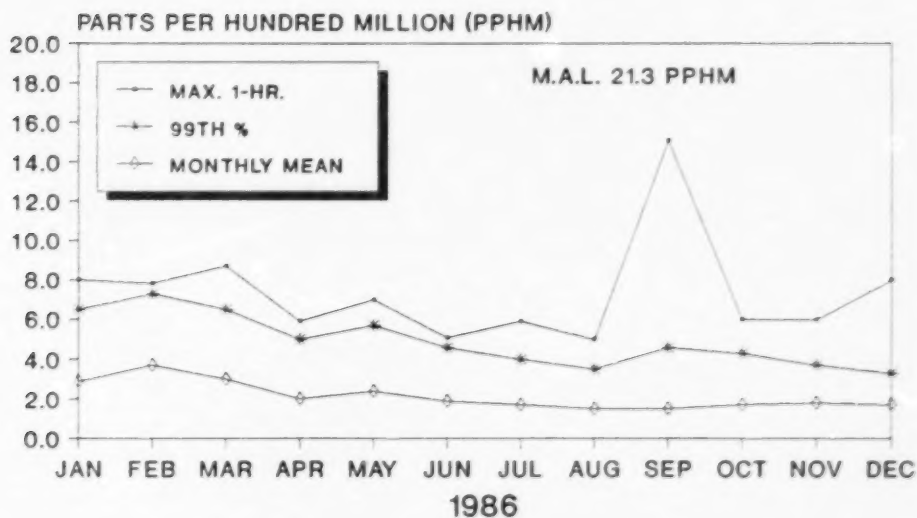


Figure 10

NITROGEN DIOXIDE (NO₂)
BRANDON ASSN. COMM. COLLEGE #5131
1-Hour Samples

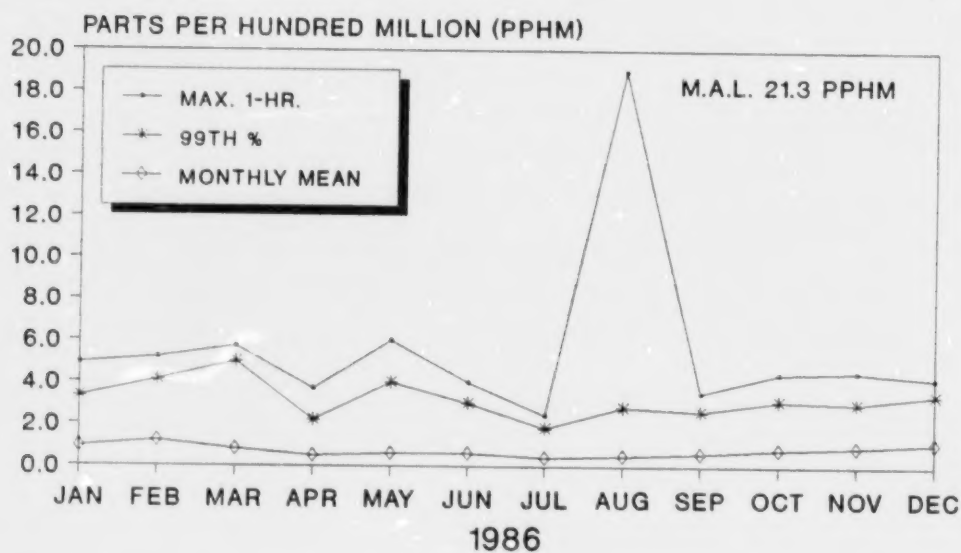


Figure 11

OZONE (O₃) WINNIPEG, SCOTIA & JEFFERSON #9118 1-Hour Samples

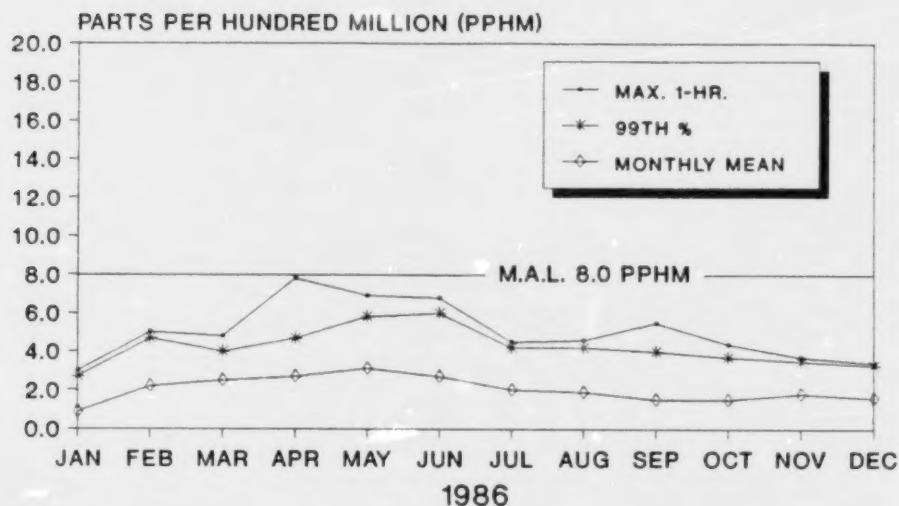


Figure 12

OZONE (O₃) WINNIPEG, 65 ELLEN ST. #9119 1-Hour Samples

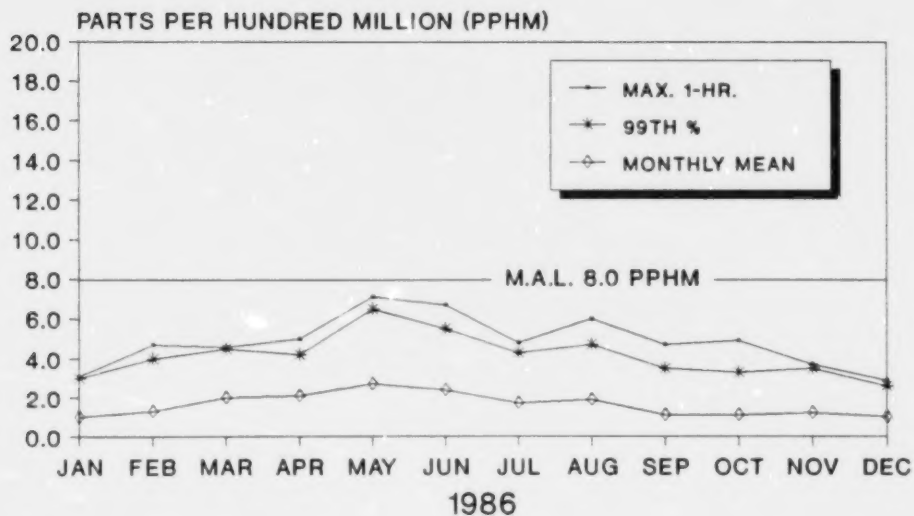


Figure 13

OZONE (O₃)
BRANDON ASSN. COMM. COLLEGE #5131
1-Hour Samples

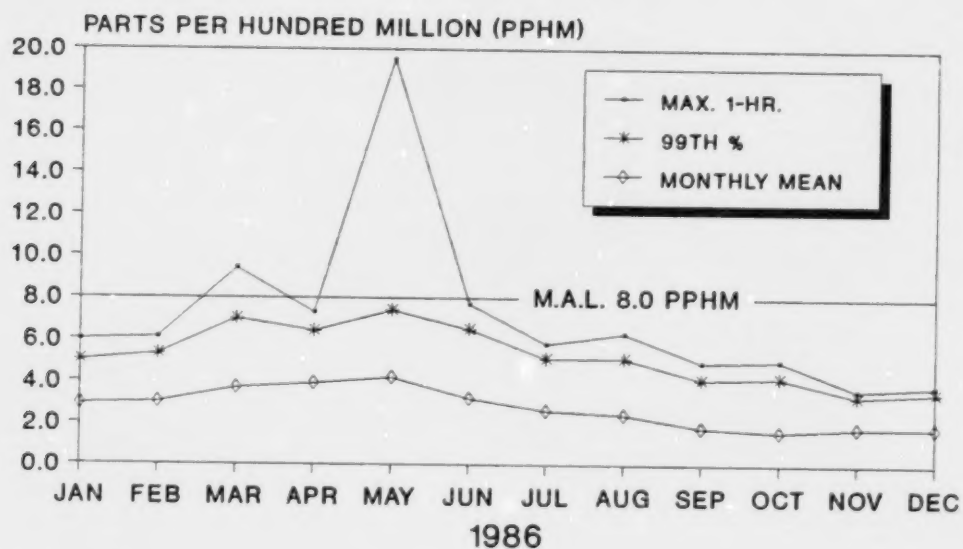


Figure 14

SOILING INDEX (COH) WINNIPEG, SCOTIA & JEFFERSON #9118 2-Hour Samples

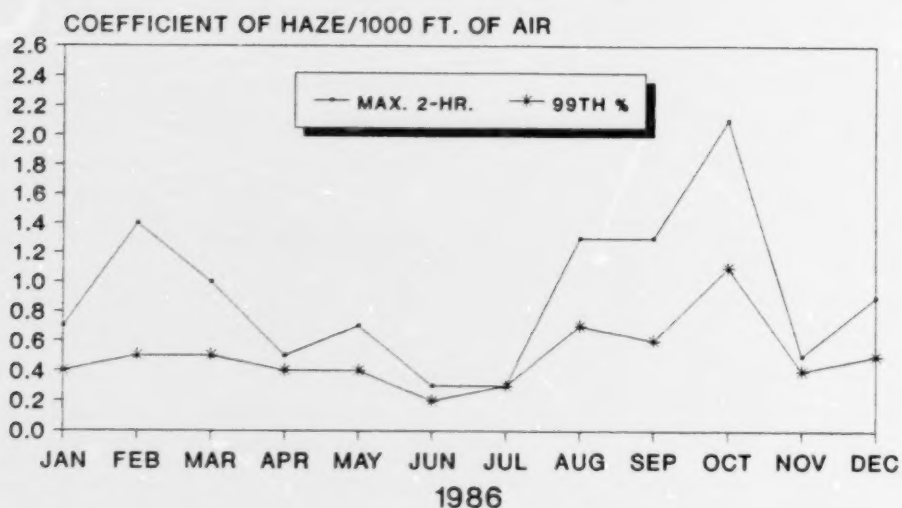


Figure 15

SOILING INDEX (COH) WINNIPEG, 65 ELLEN ST. #9119 2-Hour Samples

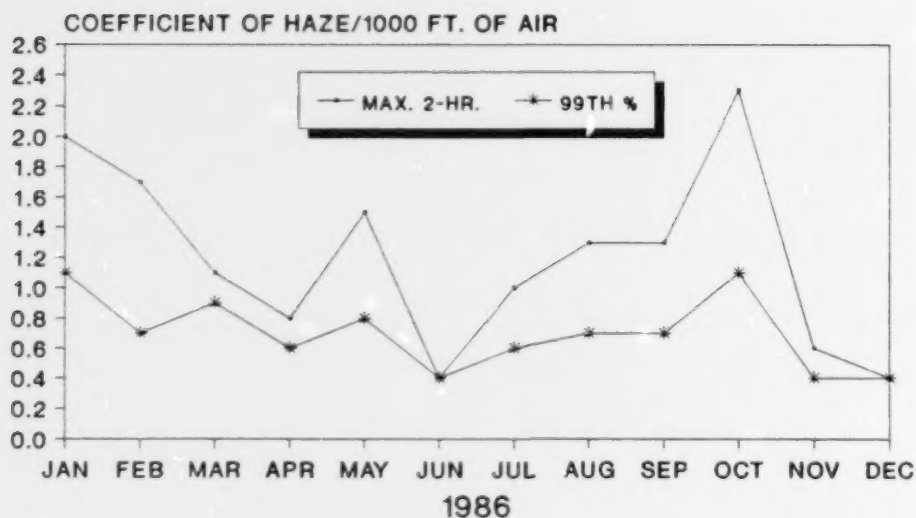


Figure 16

AMMONIA (NH₃) **BRANDON ASSN. COMM. COLLEGE #5131** **1-Hour Samples**

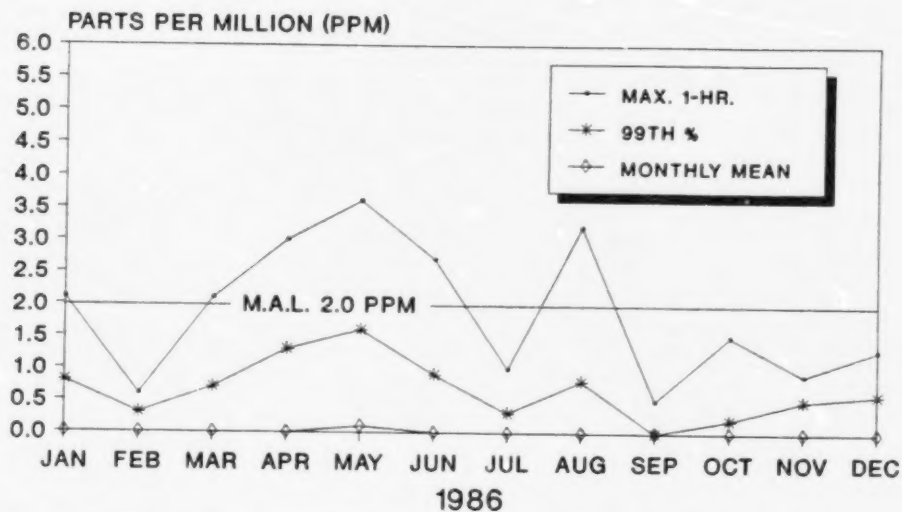


Figure 17

AMMONIA EXCEEDENCES **BRANDON ASSN. COMM. COLLEGE #5131** **1-Hour Samples**

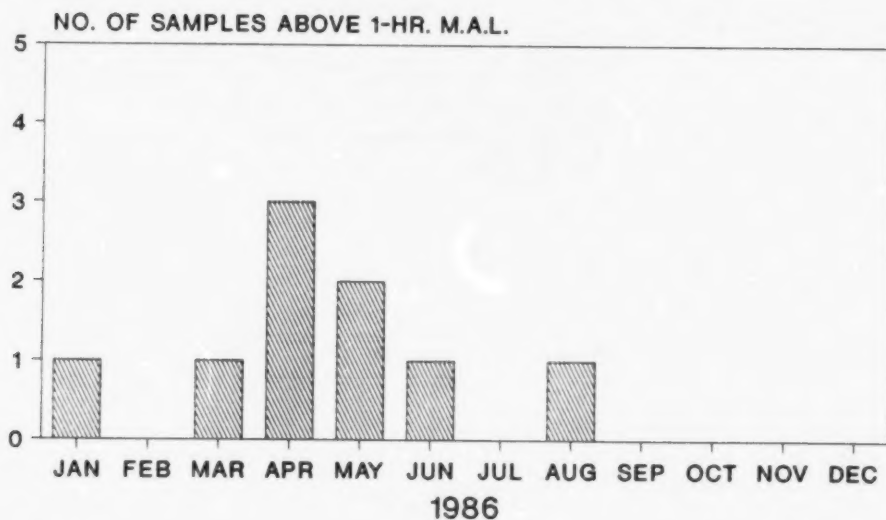


Figure 18

SULPHUR DIOXIDE (SO₂) FLIN FLON - DOWNTOWN #7233 1-Hour Samples

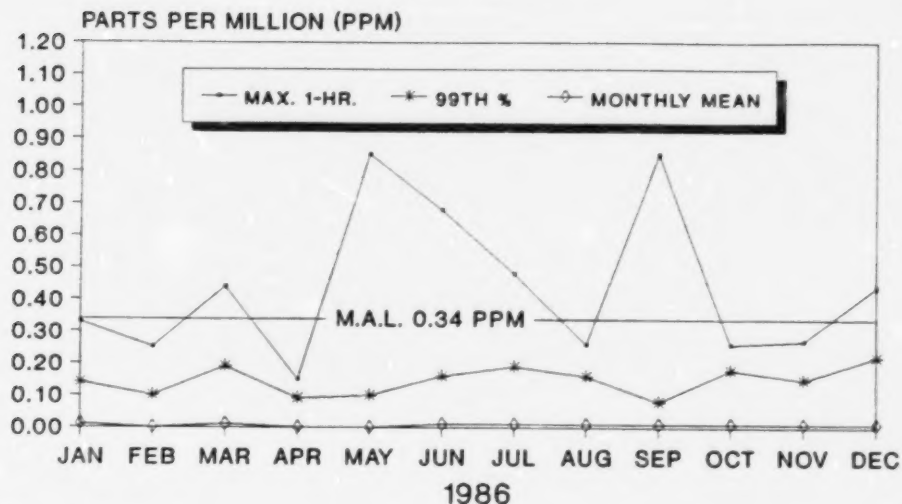


Figure 19

SULPHUR DIOXIDE (SO₂) FLIN FLON - CHANNING #7222 1-Hour Samples

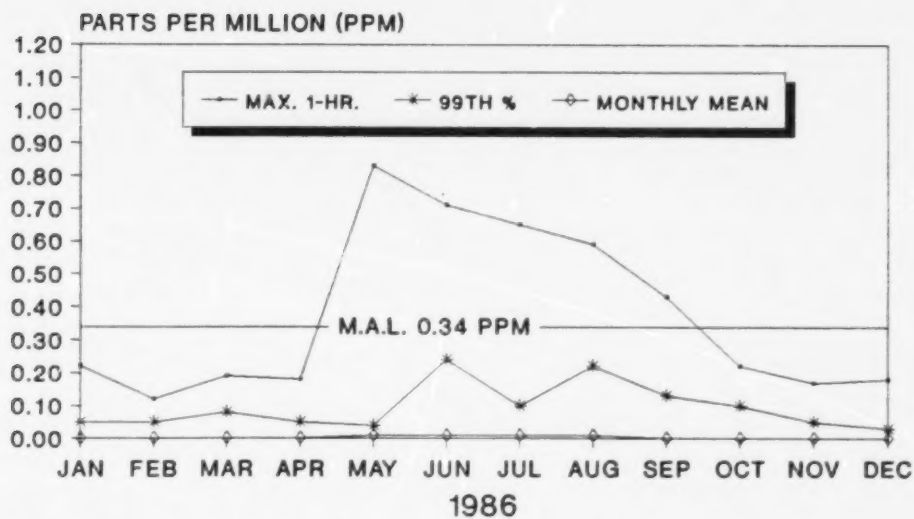


Figure 20

SULPHUR DIOXIDE (SO₂)
THOMPSON, 59 ELIZABETH DR. #7344
1-Hour Samples

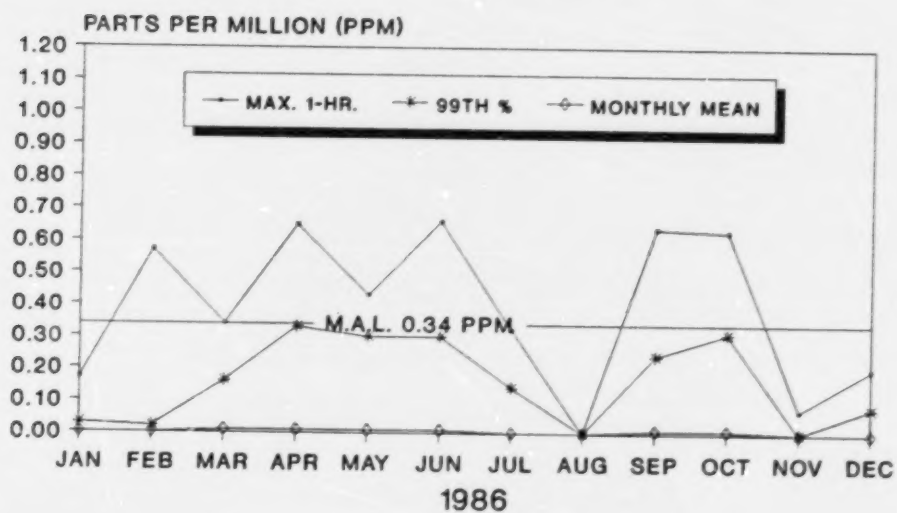


Figure 21

HYDROGEN SULPHIDE (H₂S)
THE PAS PROV. BLDG. #7111
1-Hour Samples

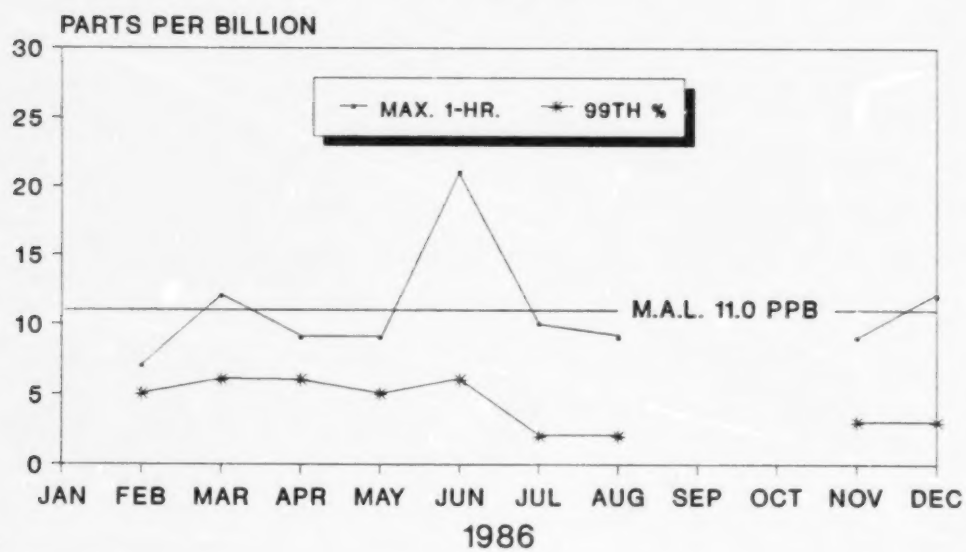


Figure 22

TOTAL SUSPENDED PARTICULATE WINNIPEG, SCOTIA & JEFFERSON #9118 24-Hour Samples

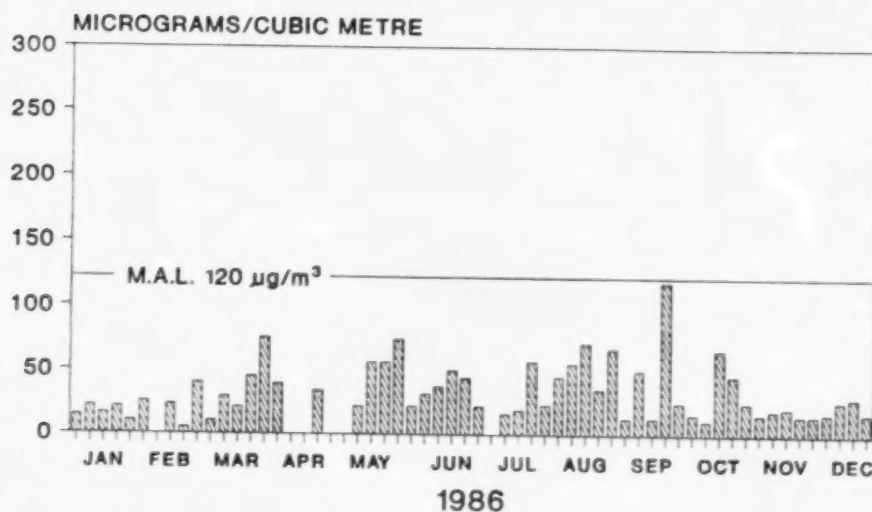


Figure 23

TOTAL SUSPENDED PARTICULATE WINNIPEG, 65 ELLEN ST. #9119 24-Hour Samples

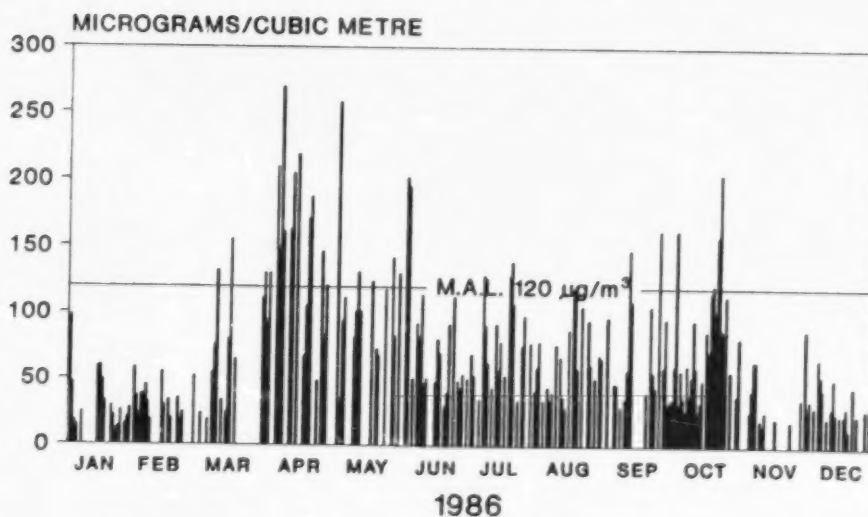


Figure 24

**TOTAL SUSPENDED PARTICULATE
WINNIPEG, 2120 PORTAGE AVE. #9102
24-Hour Samples**

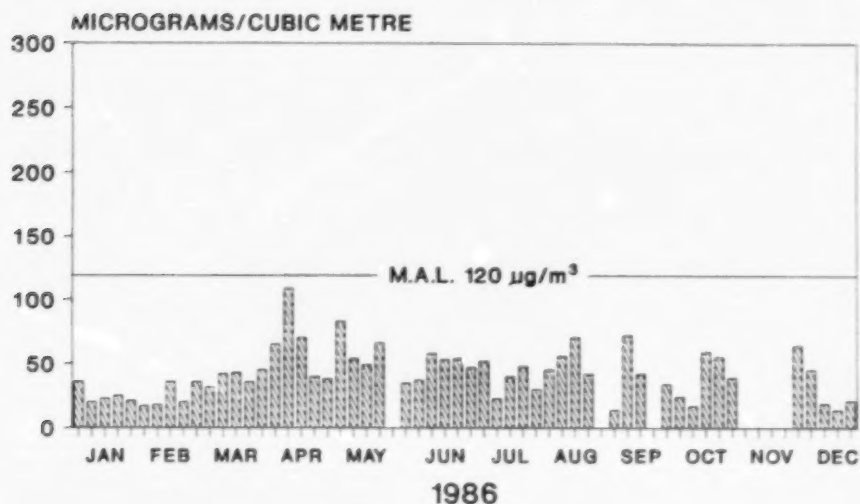


Figure 25

**TOTAL SUSPENDED PARTICULATE
ST. FRANCOIS-XAVIER #4304
24-Hour Samples**

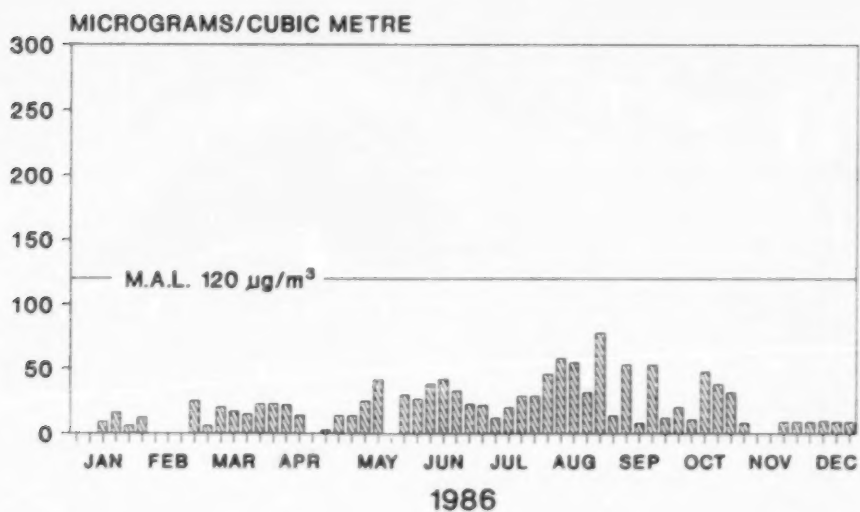


Figure 26

**TOTAL SUSPENDED PARTICULATE
BRANDON, 1104 PRINCESS AVE. #9201
24-Hour Samples**

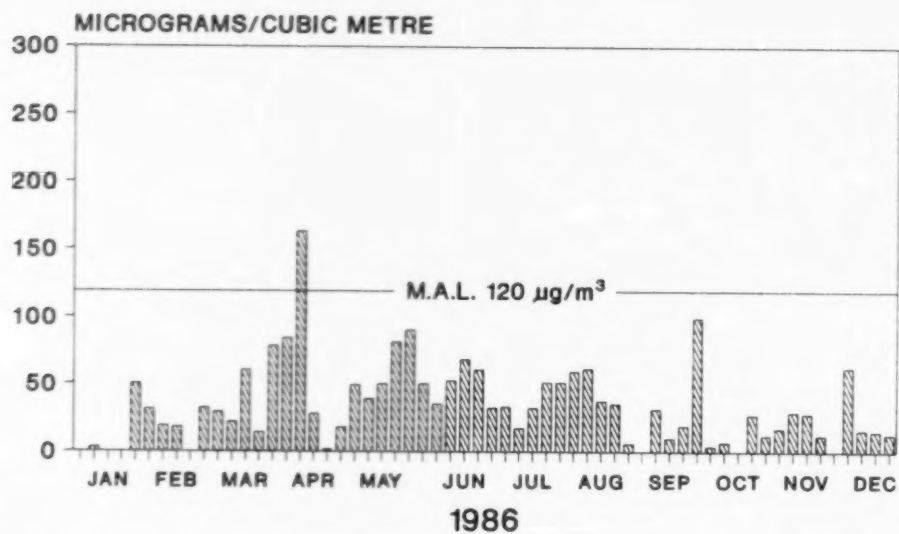


Figure 27

LEAD
WINNIPEG, SCOTIA & JEFFERSON #9118
24 Hour Samples

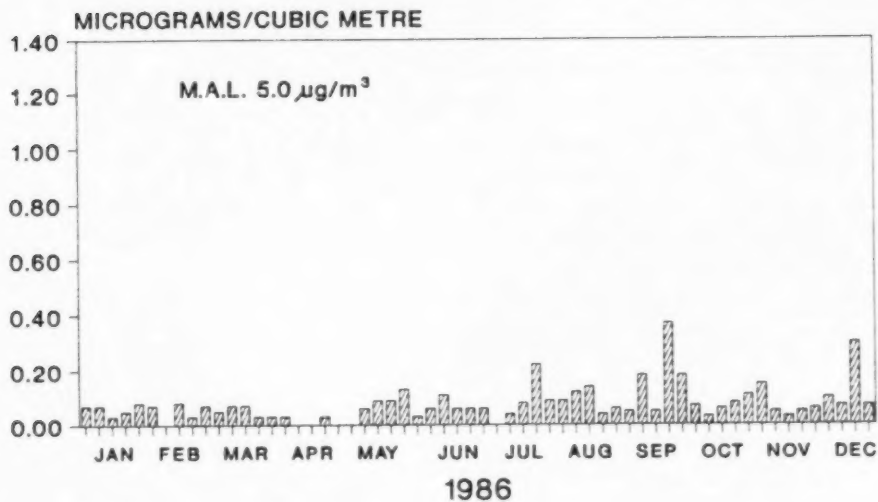


Figure 28

LEAD
WINNIPEG, 65 ELLEN ST. #9119
24 Hour Samples

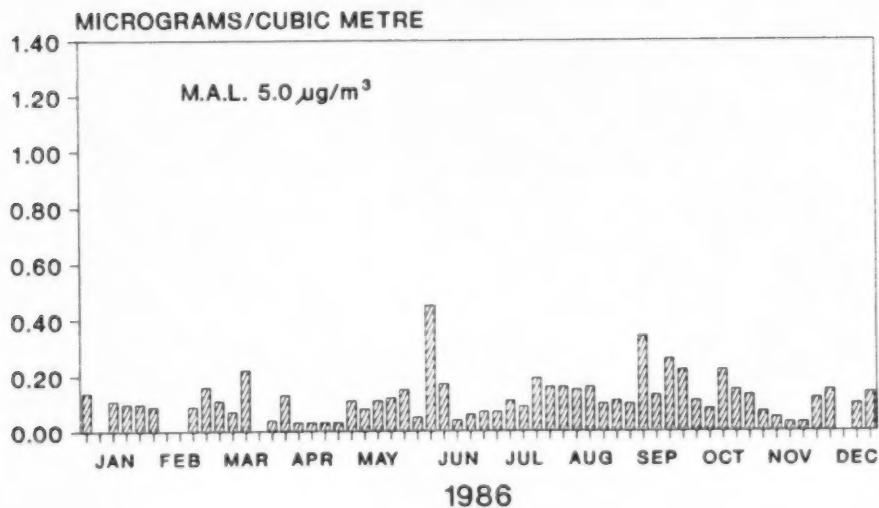


Figure 29

LEAD
WINNIPEG, 2120 PORTAGE AVE. #9102
24 Hour Samples

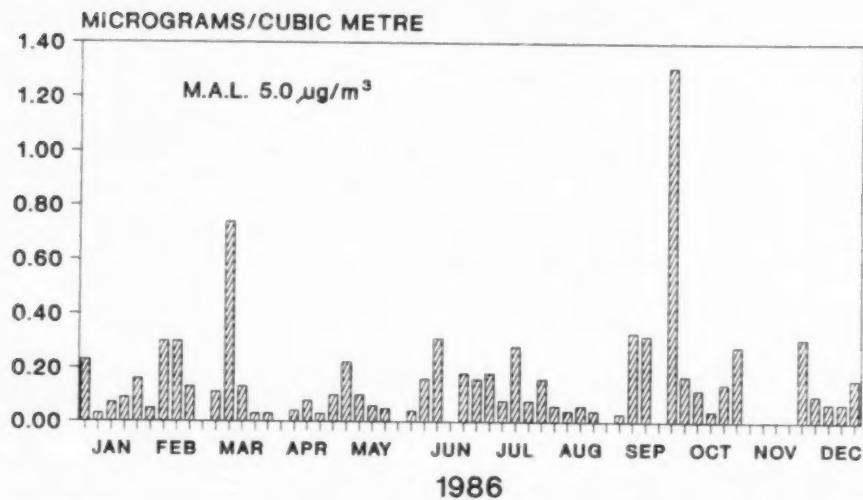


Figure 30

LEAD
ST. FRANCOIS-XAVIER #4304
24 Hour Samples

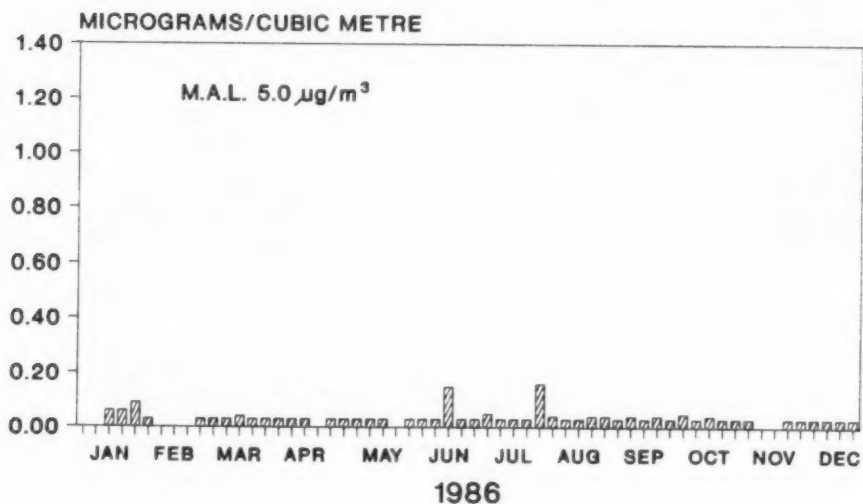


Figure 31

M.A.L. 5.0 $\mu\text{g}/\text{m}^3$

Month	Mean Concentration ($\mu\text{g}/\text{m}^3$)
JAN	0.00
FEB	0.08
MAR	0.24
APR	0.12
MAY	0.08
JUN	0.05
JUL	0.05
AUG	0.08
SEP	0.02
OCT	0.02
NOV	0.05
DEC	0.18

1986

1

SULPHATE
WINNIPEG, SCOTIA & JEFFERSON #9118
24 Hour Samples

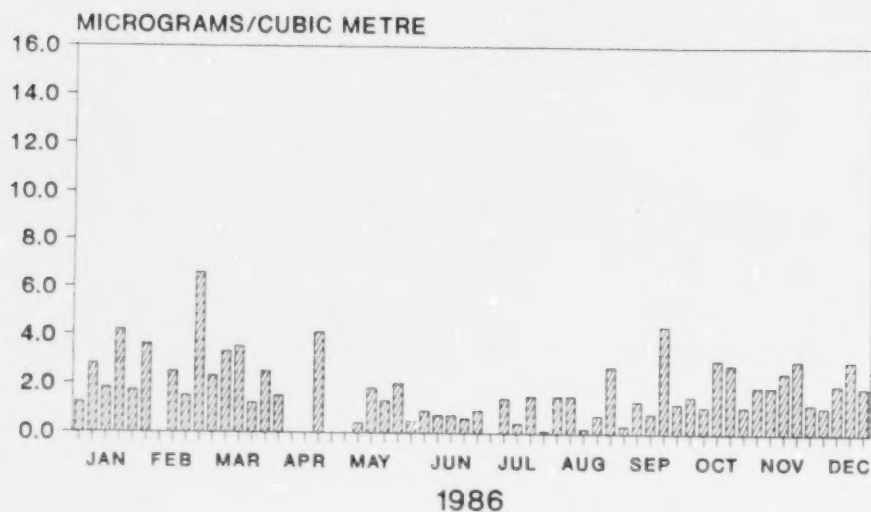


Figure 33

SULPHATE
WINNIPEG, 65 ELLEN ST. #9119
24 Hour Samples

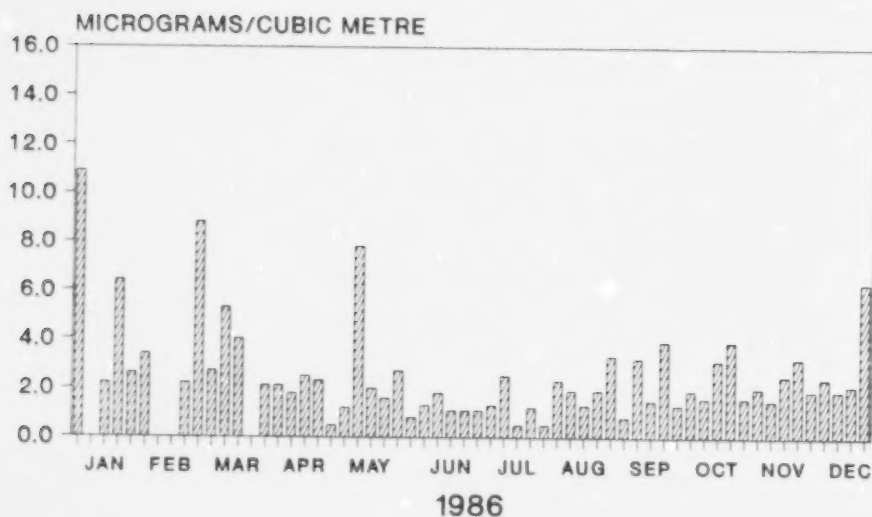
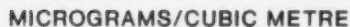


Figure 34

SULPHATE

WINNIPEG, 2120 PORTAGE AVE. #9102

24 Hour Samples



1986

SULPHATE

ST. FRANCOIS-XAVIER #4304

24 Hour Samples



1986

SULPHATE
BRANDON, 1104 PRINCESS AVE. #9201
24 Hour Samples

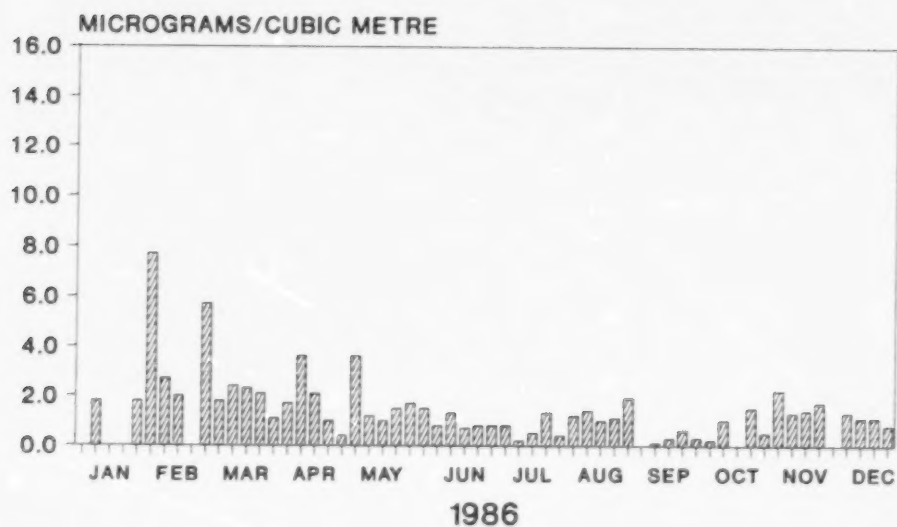


Figure 37

NITRATE
WINNIPEG, SCOTIA & JEFFERSON #9118
24 Hour Samples

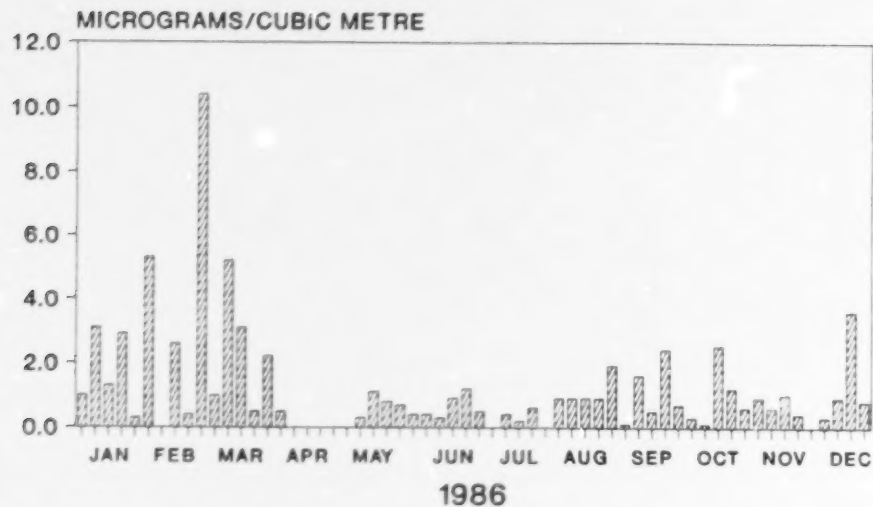


Figure 38

NITRATE
WINNIPEG, 65 ELLEN ST. #9119
24 Hour Samples

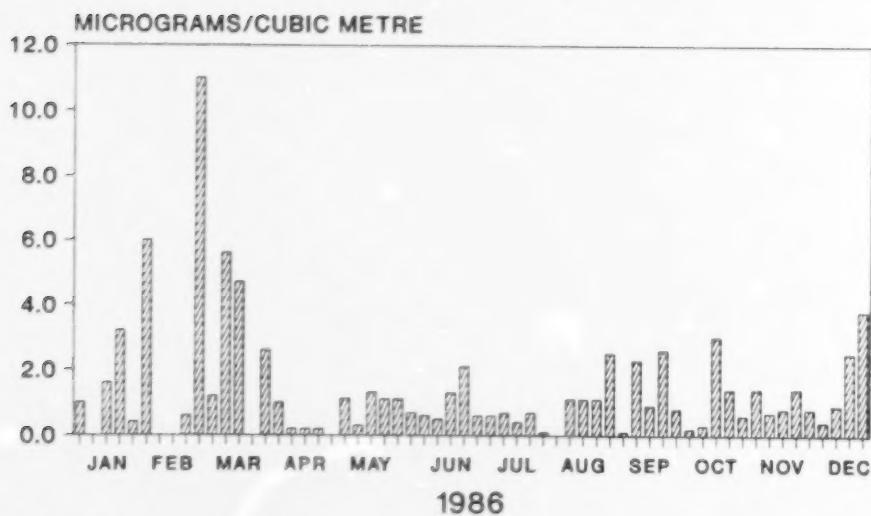


Figure 39

NITRATE
WINNIPEG, 2120 PORTAGE AVE. #9102
24 Hour Samples

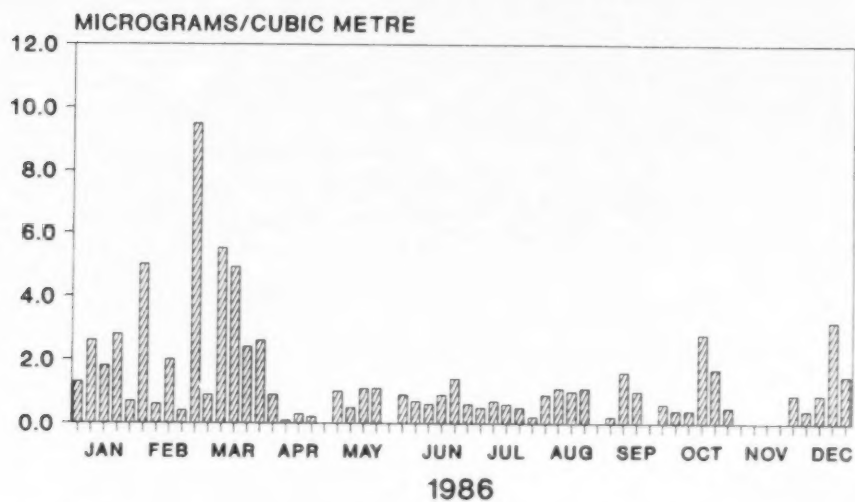


Figure 40

NITRATE
ST. FRANCOIS-XAVIER #4304
24 Hour Samples

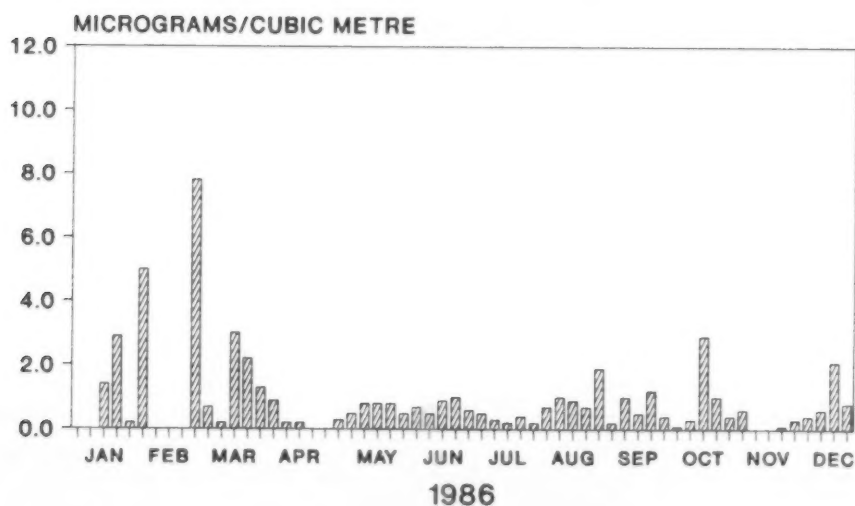


Figure 41

NITRATE
BRANDON, 1104 PRINCESS AVE. #9201
24 Hour Samples

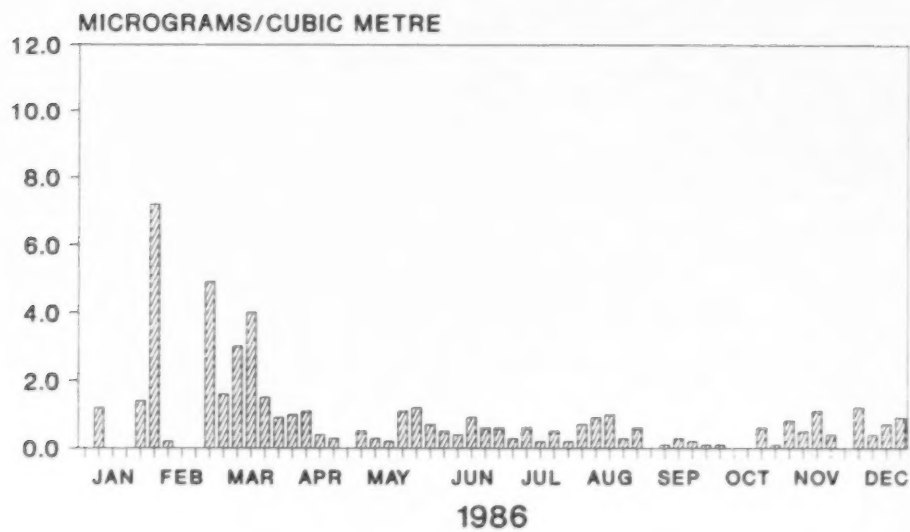


Figure 42